**Exam 1**
**Organic Chemistry C3444—Section 2**
**Prof. Nuckolls**
**February 15, 2002**

- **Write your name on every page.**
- **You should have 7 pages including this one.**
- **Turn off your cellular phones.**
- **Do your own work.**
- **Good Luck!**

**Name: _____**

**Columbia I.D. #: _____**

**Signature: _____**

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**Grading:**
**Section 1 _____ /40 points**

**Section 2 _____ /30 points**

**Section 3 _____ /30 points**
**_____**

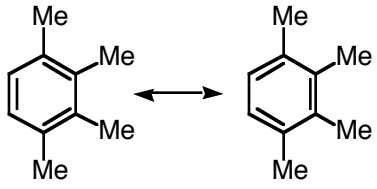
**Total _____ /100 points**

**Name:**

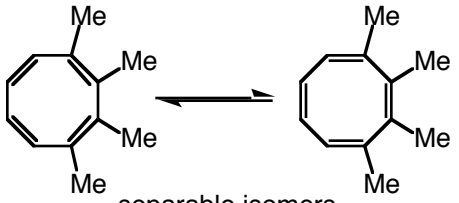
## Section 1. Answer the following questions in the space provided. (10 points each, 40 points total)

1. How many proton NMR resonances would you expect for the molecule below when it is dissolved in water? Explain in *two sentences or less*.


2. The structures on the left are resonance structures, and so the two compounds can not be isolated from each other. The structures on the right are in equilibrium, but they do not interconvert below 150°C! Draw pictures showing how the interconversion for the right equation takes place. In two sentences or less, how do these pictures explain the wildly different values for interconversion?



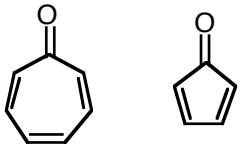

resonance structures



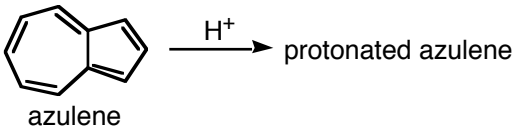

separable isomers

**Name:**

3. Draw the product when each of the two compounds is protonated on the oxygen. Through resonance structures, predict which compound is more basic.



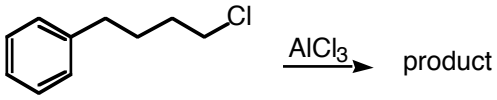

4. Circle the position that azulene protonates. Describe why you chose that position with pictures and *two sentences or less*.



**Name:**

**Section 2. Answer the following questions in the space provided. (10 points each, 30 points total)**

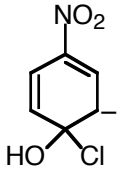
1. Draw the product from the following transformation and its mechanism of formation.

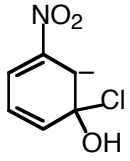



2. Draw a step-wise mechanism for the formation of the electrophilic species that nitrates aromatic compounds when sulfuric acid is mixed with nitric acid?

**Name:**

3. Draw all resonance structures for the two anions shown below. Based on these structures predict which of the two anions is more stable.

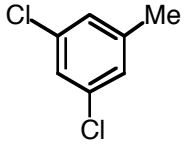


**Name:**

## Section 3. (15 points each, 30 points total).

1. Starting with benzene, draw a step-wise synthesis for the compound below.



**Name:**

2. From the two starting materials shown, show the steps to synthesize the compound below.