

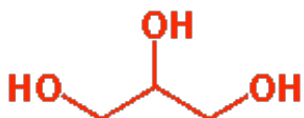
**CHEM 163 MIDTERM**  
**February 10, 1998**  
**Dr. John C. Vederas**

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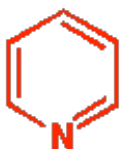
**I. Structure and Nomenclature - 47 Points**

**A.** Draw structures for which names are given, or name the given structures by any correct (systematic or common) nomenclature. Be sure to give cis or trans (or if appropriate Z or E) or R or S assignment to the isomer where indicated by asterisks (\*\*\*) . **(2 points each - 20 points total)**

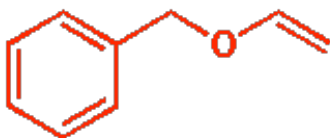
1. glycerol (lubricant, also present in human cells)



2. pyridine (common solvent)



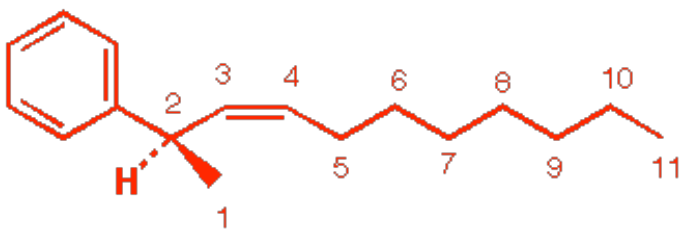
3. benzyl vinyl ether



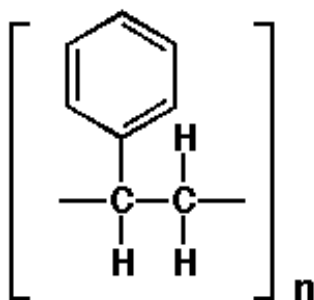
4. allyl alcohol



5. (R)-cis-2-phenyl-3-undecene (use part structure below in your drawing to assist grading)



- 6.



A common substance on beaches

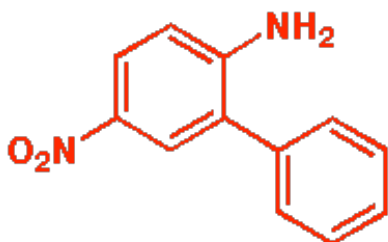
**Polystyrene**

7.

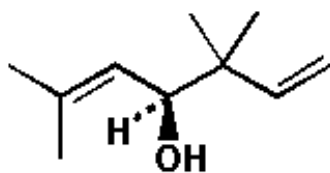


**(R)-1-methoxy-2-methyl-2-pentanol**

8. 2-phenyl-4-nitroaniline



9.

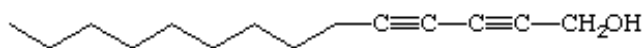


perfume

constituent of artemesia plants

**(S)-3,3,6-trimethyl-1,5-heptadien-4-ol**

10. sperm attractant for coral polyps

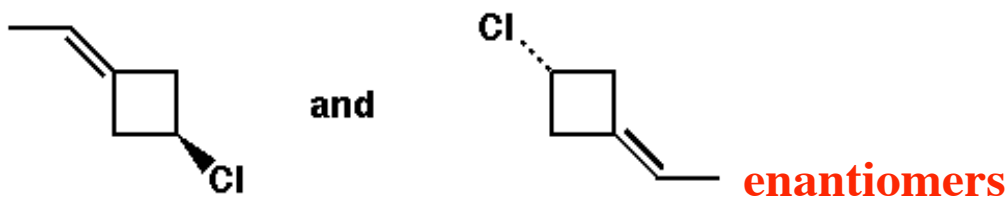


**2,4-tetradecadiyne-1-ol**

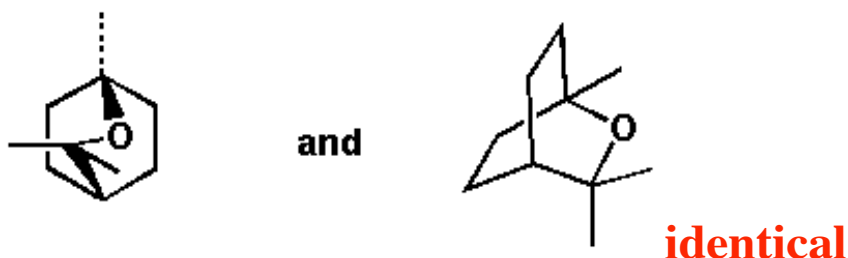
B. Determine whether the following pairs of structures are identical (i.e. different pictures of the same

molecule), structural isomers, diastereomers, or enantiomers. (2 points each - 8 pts total).

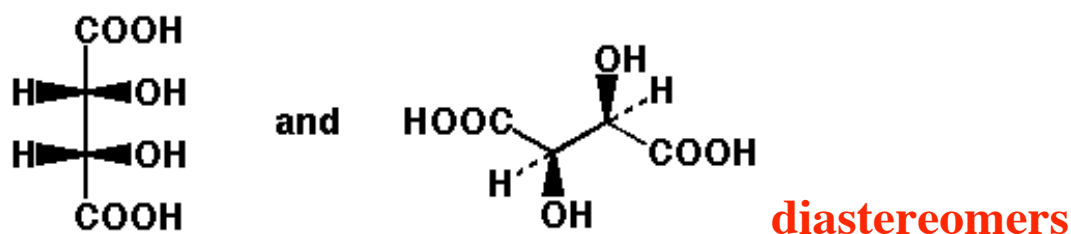
1.



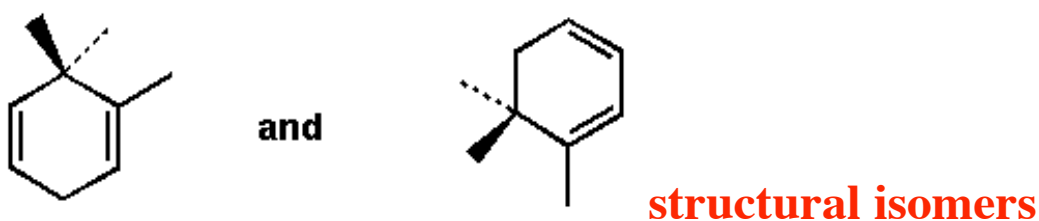
2.



3.

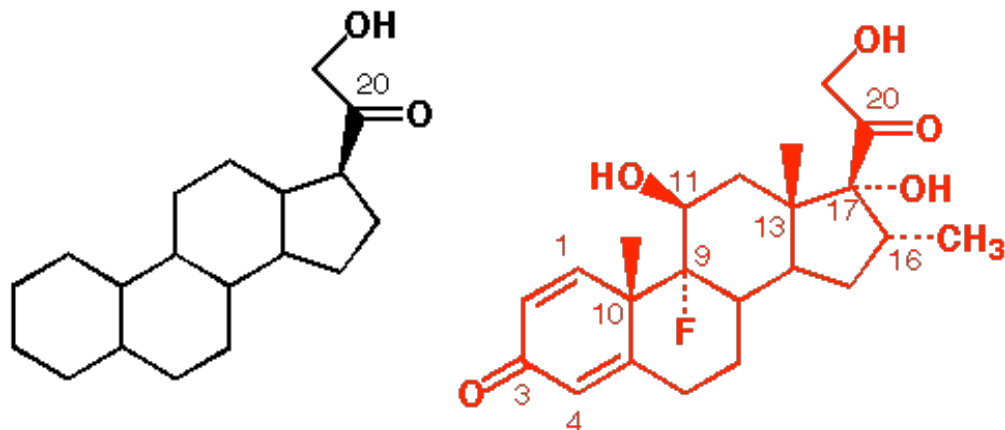


4.



**C. 1.** Dexamethasone is a synthetic drug which mimics the anti-inflammatory properties of adrenocorticoid hormones such as cortisone in treatment of rheumatoid arthritis, and has also been used for treatment of depression. It does have serious side effects, such as excessive appetite and water retention. Its complete chemical name is 9- $\alpha$ -fluoro-16 $\alpha$ -methyl-11 $\beta$ ,17 $\alpha$ ,21-trihydroxypregna-1,4-diene-3,20-dione. Complete its structure using the partial drawing given below. Be sure to provide correct stereochemistry (do not forget the b-

methyl group(s) which are part of the basic skeleton). (9 points total)



2. Answer the following questions by giving the correct numbers (1 point each): (3 pts total)

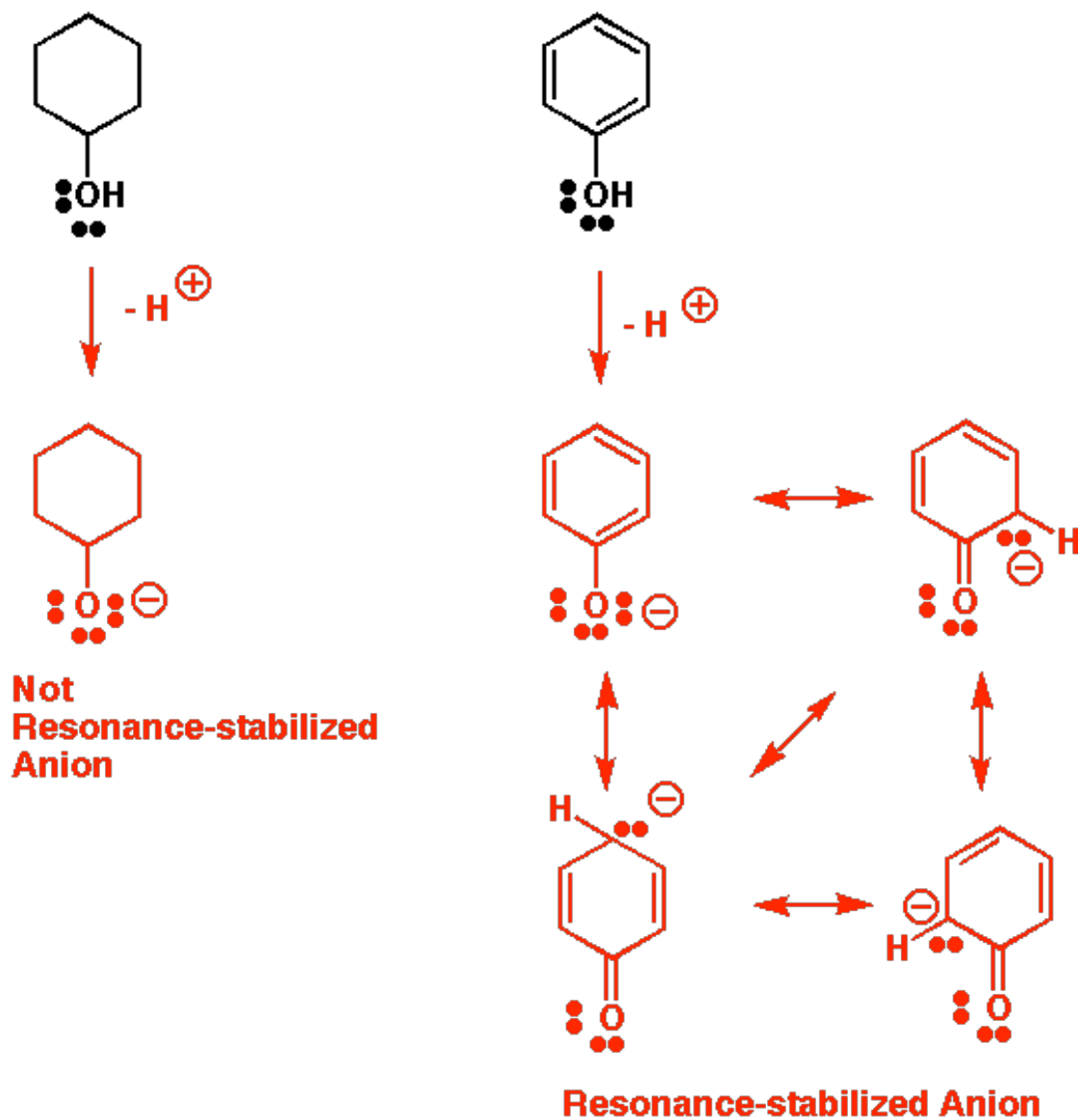
- The number of carbons in the dexamethasone molecule is: **22**
- The number of stereogenic (i.e. chiral) centres in dexamethasone is: **8**  
(carbons 8,9,10,11,13,14,16,17)
- The number of hydrogens in the dexamethasone is: **29**

3. Indicate whether the following statements are true (T) or false (F). No penalty for guessing. (1 pt each - 6 pts total)

- Changing all but one of the stereocenters in dexamethasone to the opposite stereochemistry will generate a diastereomer **True**
- Changing the 17alpha hydroxy group in dexamethasone to beta (beta) will generate an enantiomer. **False**
- Dexamethasone has the same number of carbons as the pregnancy hormone, progesterone. **False**
- A human produces about 1 gram of male or female sex hormone per day. **False**
- Cholesterol is obtained only in the diet by humans. **False**
- The difference between androgen and estrogen skeletons is one methyl group. **True**

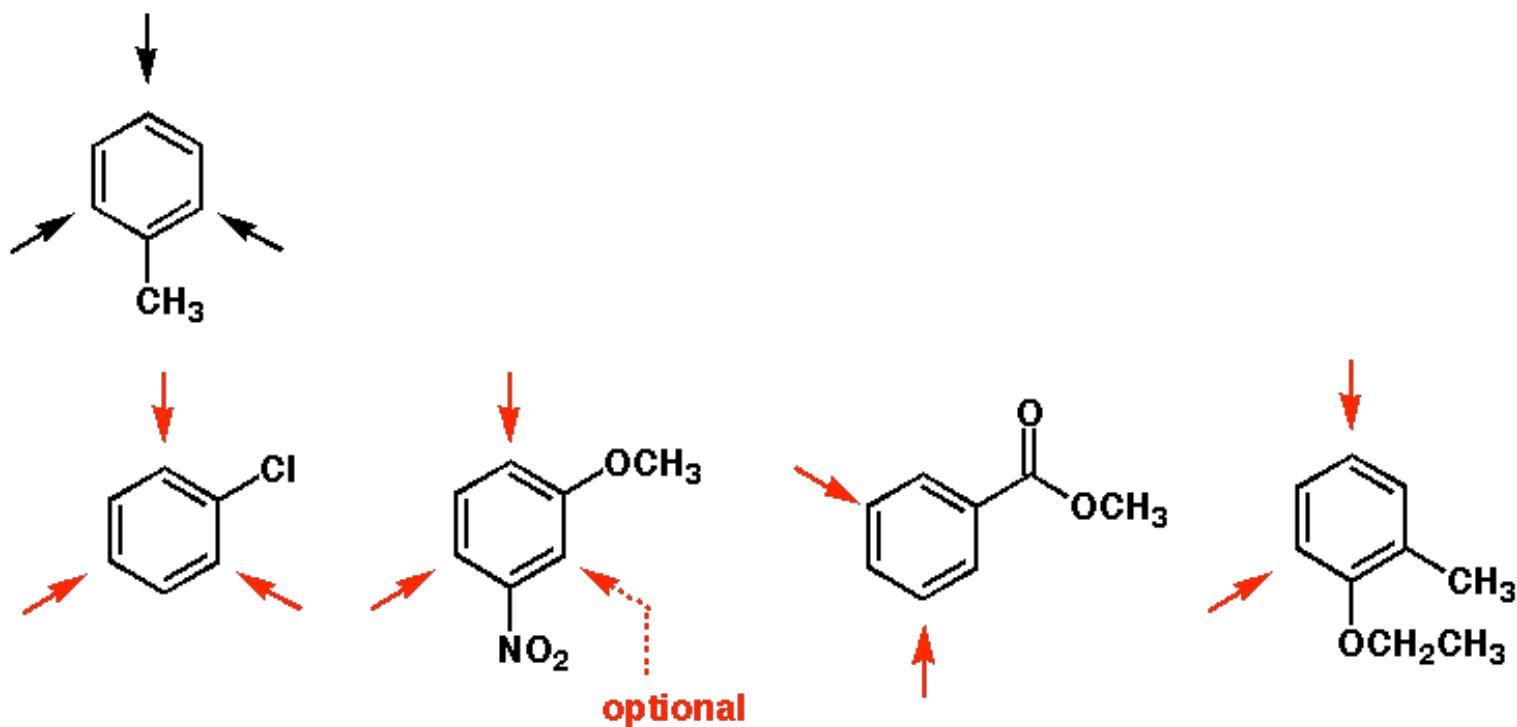
## II. Physical Properties and Reactivity - 13 Points

A. Use twenty words or less and at least three resonance structures to explain why phenol is much more acidic than cyclohexanol (by a factor of ca 10<sup>7</sup>) (4 pts)

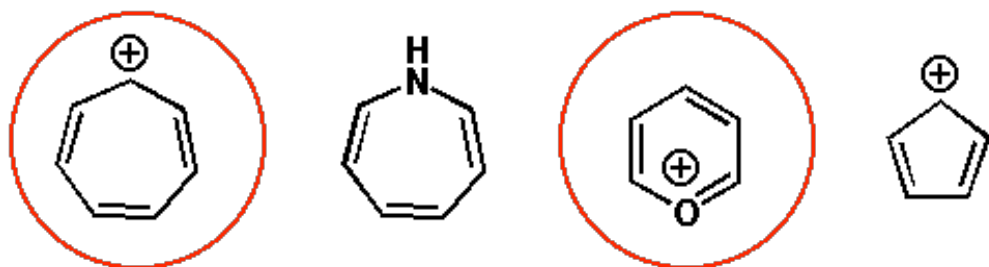


**B.** In the group below use an arrow to indicate the position(s) on the aromatic ring which would be most likely to be attacked by chlorine in the presence of  $FeCl_3$ . (4 pts - 1 pt each)

Example:



C. In the group below Circle all aromatic compounds or ions. (4 pts)



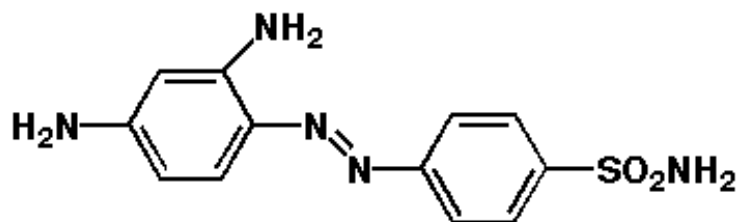
### III. Definitions and Applications - 9 Points

A. Furan is a heterocyclic aromatic compound that occurs in oils obtained by distillation of pine resin. Its molecular formula is  $C_4H_4O$ . In the part structure below draw the p atomic orbitals involved in forming the aromatic system in correct geometry. One has been drawn for you already. Also indicate the geometry of any orbital(s) having a lone (unshared) pair of electrons that are not part of the aromatic system. If there are none that fit this description, write "No additional lone pairs" (3 points)



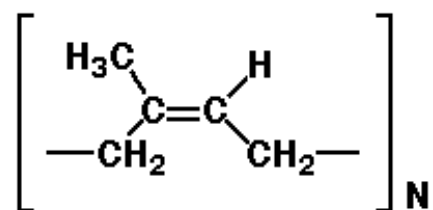
B. The three compounds shown below were discussed in class. Identify them by common name and briefly (10 words or less) describe their importance or use. (6 pts total - 2 pt each)

1.



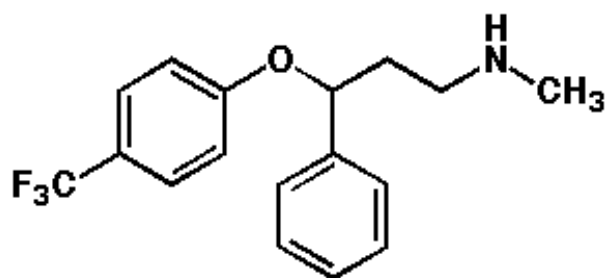
**Prontosil - the first Sulfa Drug precursor - Antibiotic discovered by Gerhard Domagk**

2.



**Rubber or Polyisoprene (cis) - used in tires etc**

3.

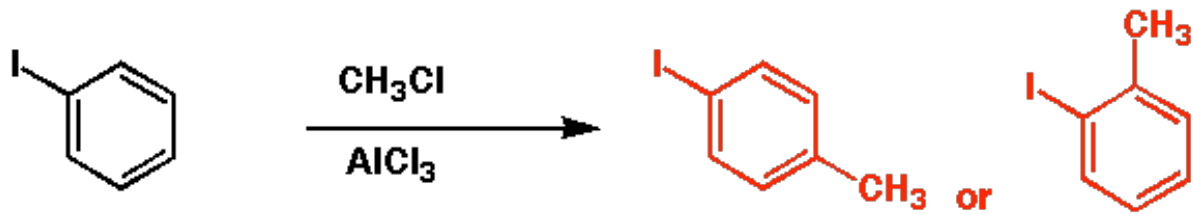


**Prozac or Fluoxetine - Most widely used Antidepressant - Serotonin Uptake Inhibitor**

#### IV. Reactions - 16 Points

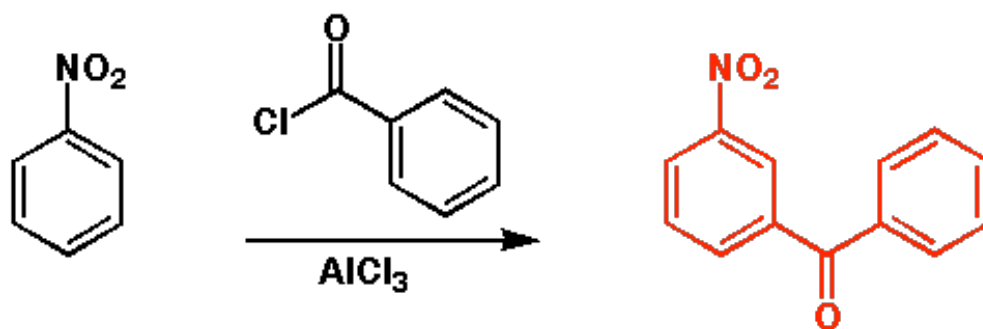
A. Show the structure of the major organic product of each of the following reactions. Show stereochemistry where indicated by asterisks (\*\*). (2 points each - 8 points total)

1.

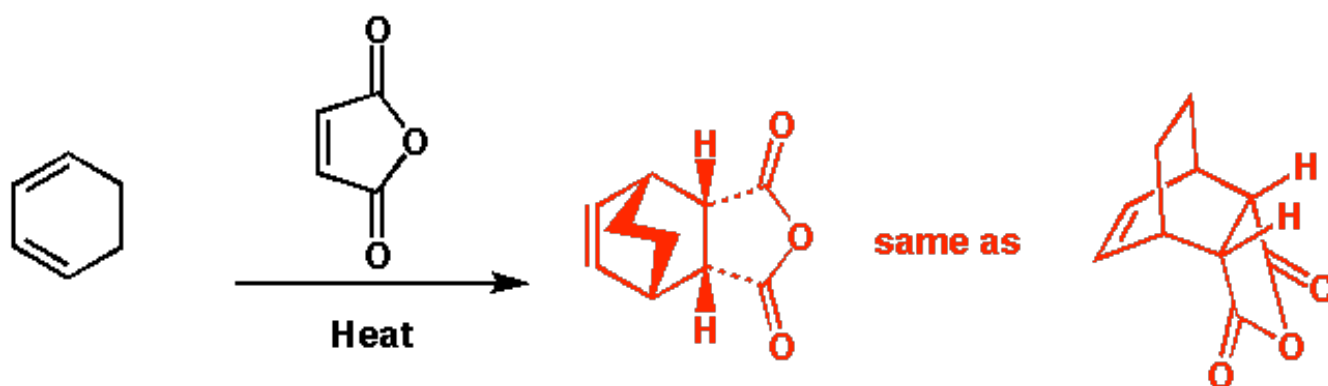


assigned problem 25.32

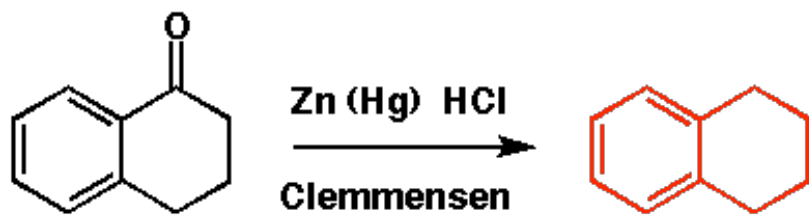
2.



3.



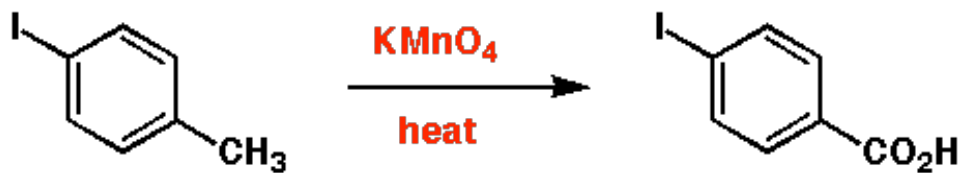
4.



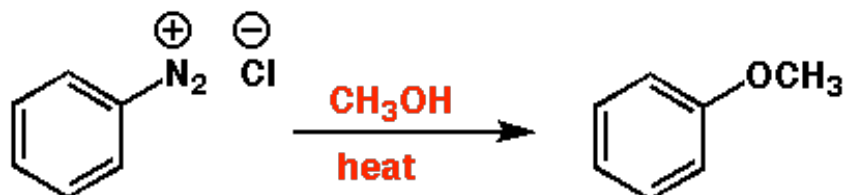
**B.** Show reagents that will do the required transformations. In some cases two or three steps may be necessary. (2 pts each - 8 pts total)

1.

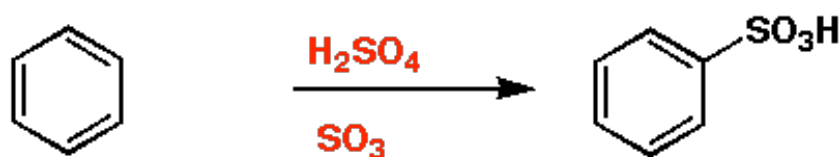




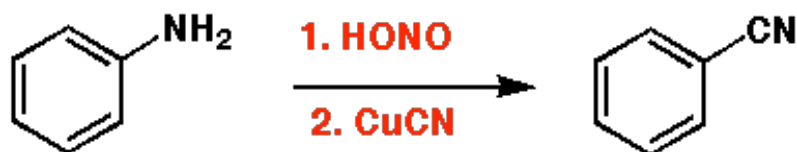
2.



3.



4.



or instead of HONO use  $\text{NaNO}_2$  and  $\text{H}^+$

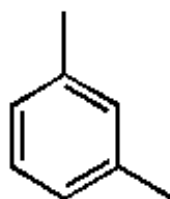
## V. Synthesis and Mechanism - 13 Points

A. Musk ketone is a synthetic compound widely used in perfumes. Outline a short synthesis of the compound from *meta*-xylene (dimethylbenzene) and any other necessary organic or inorganic reagents. (4 points)

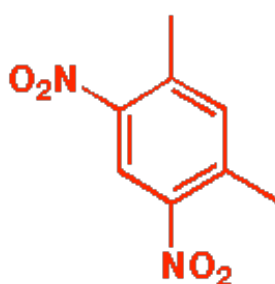
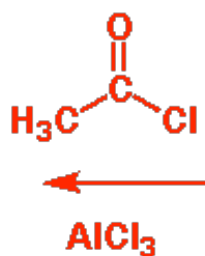
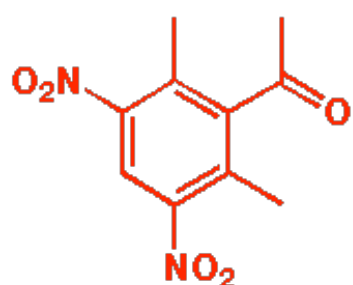
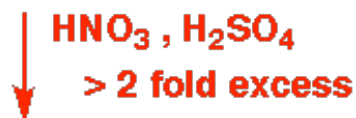


**musk ketone**

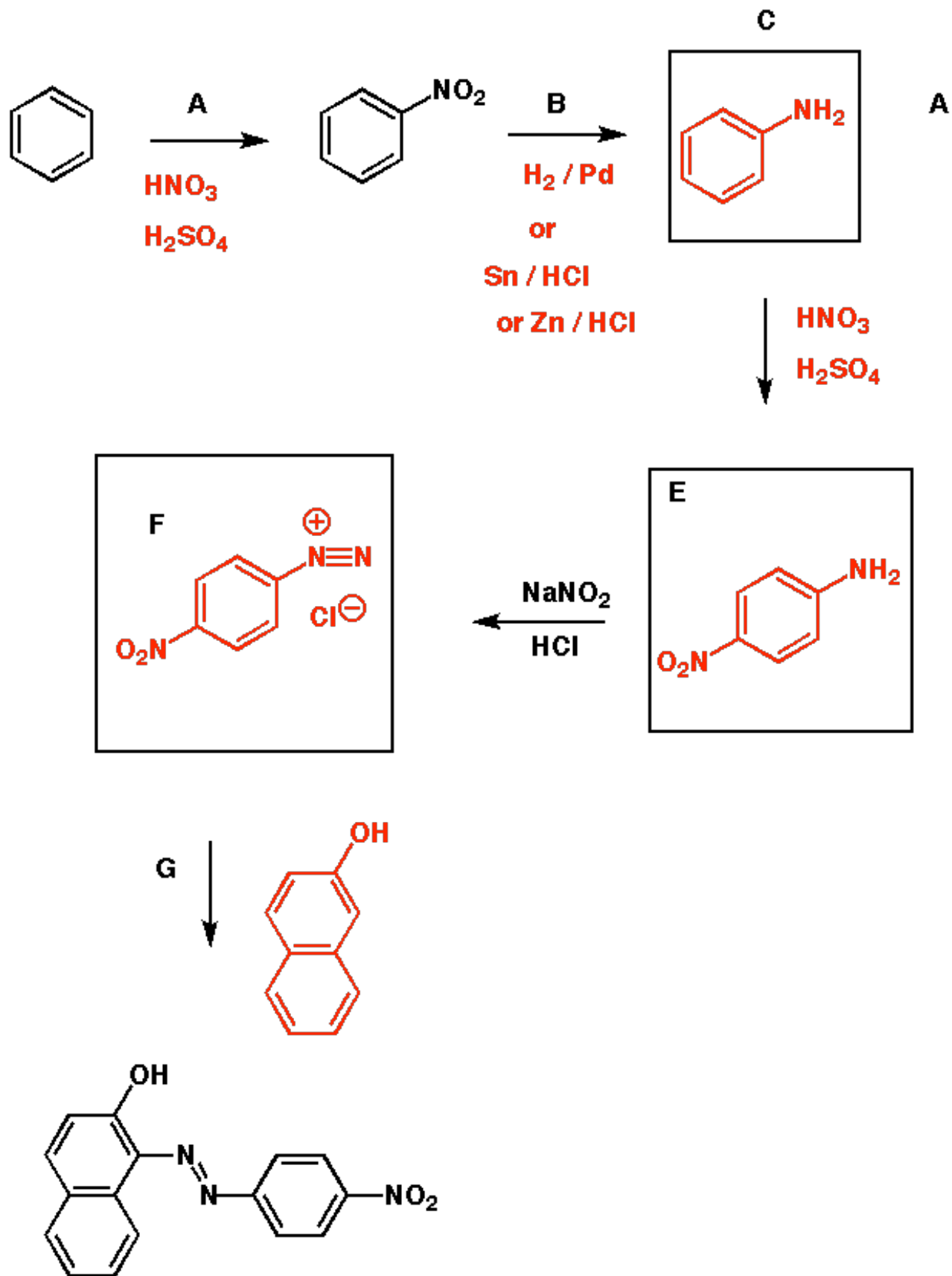
from



**meta-xylene**



**B.** The dye Para Red can be synthesized from benzene and another organic compound **G** in several steps as outlined below. The steps are shown, but are missing the necessary reagents and intermediates. Provide the missing reagents and intermediates to show how to complete the synthesis of Para Red. (7 points)



C. Provide a detailed "step by step" mechanism for the reaction shown below. Be sure to show the structures of

key intermediates and indicate the movement of electrons using the curved arrow convention. Use resonance theory to explain why two products are produced. (6 points)

