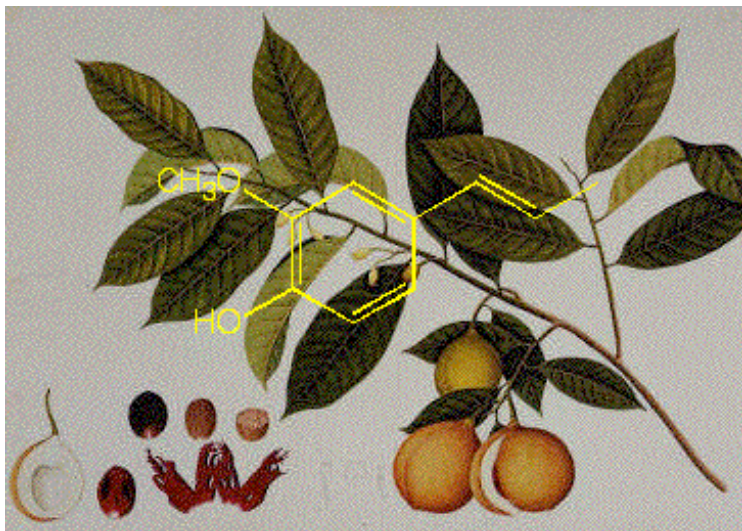


Chem 221b

Problem Set 4

Chapter 17

Due: Monday, February 14, 2005



Nutmeg (Isoeugenol)



Clove (Eugenol)

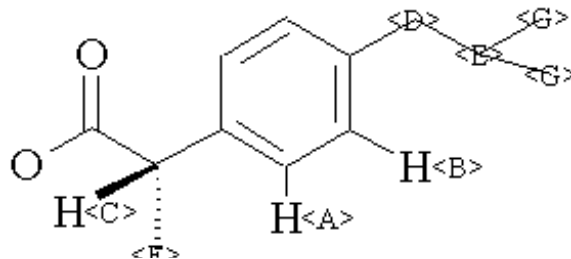
During the 16-17th century the demand in Europe for **nutmeg** (and its pod, mace) and **clove** as a flavoring, medicinal, amulet, and narcotic had a major impact on the course of world history. The sole source of these spices was the volcanic **Spice Islands** (the modern Moluccas in Indonesia). In a battle for domination of the area, the Dutch wrested the area from the Portuguese. To insure their exclusive hold on the spice trade, the Dutch bargained the new world settlement of New Amsterdam to the English in exchange (**Treaty of Breda**, 1667). The nutmeg is the seed that propagates the tree; seeds that could be spread to other islands by birds. To maintain control over and the price of the product, the **Dutch** chopped down new growth. Ultimately, clove and nutmeg were able to be grown in South America. The nickname for Connecticut, the Nutmeg State, is allegedly derived from the practice of Yankee peddlers foisting hand-carved, wooden nutmegs on unsuspecting clients. Nutmeg and clove can be toxic. Eugenol and isoeugenol are the principle aromatic compounds in clove and nutmeg, respectively.

1. Examples 4-9, 13-15, 17, 18 of the **Interactive NMR Problems** deal with aromatic compounds. Have a look.

2. a) Reconstruct the ^1H NMR spectrum of ibuprofen.

Assume no resonances overlap and all $\text{sp}^3\text{-sp}^3$ couplings have $J = 7$ Hz. Ortho coupling is ~ 8 Hz.

b) A student proposes a synthesis of ibuprofen starting from benzene and isobutyl chloride via the Friedel-Crafts reaction. Will the student obtain the expected product? If not, what

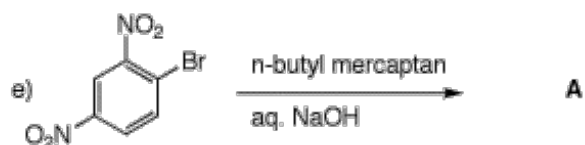
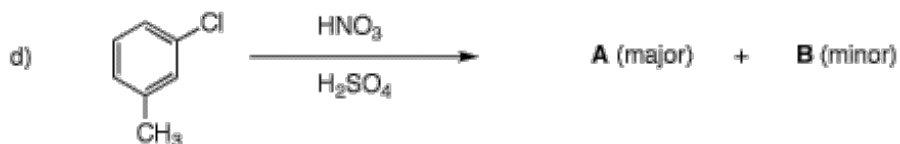
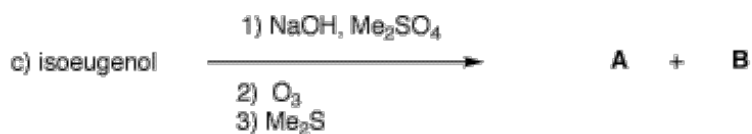
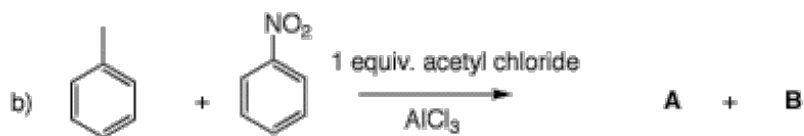
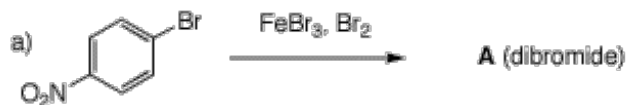


will happen.

c) Devise a viable synthesis of rac.-ibuprofen from benzene, isobutylene, methanol, and dry ice as your sources of carbon.

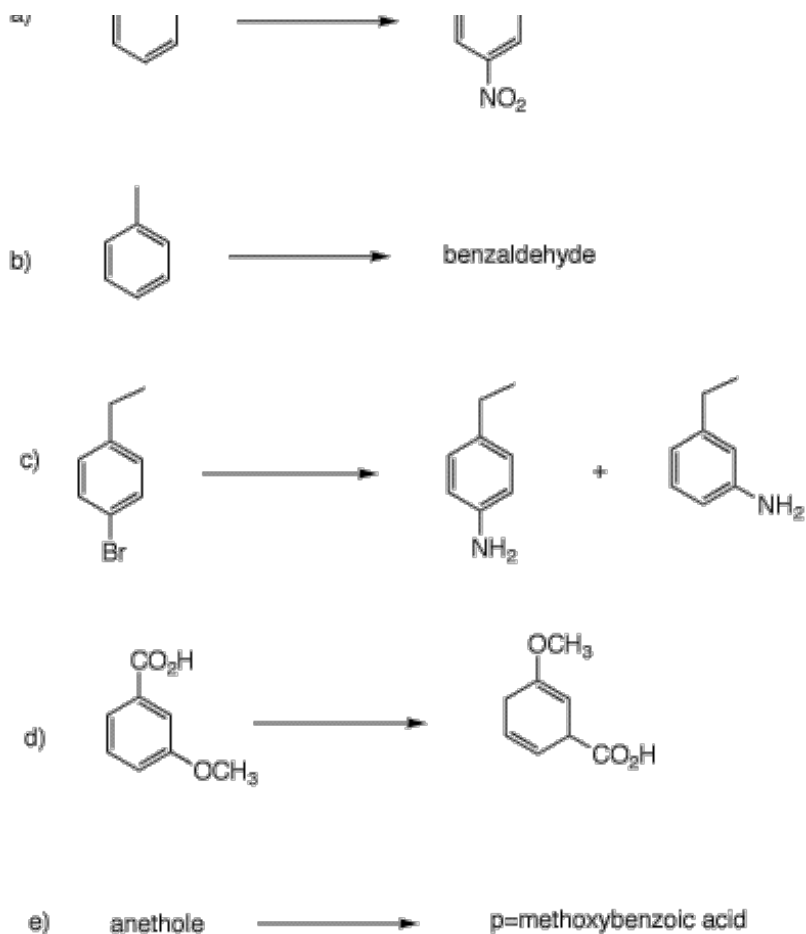
Assign.	Shift (ppm)
A	7.210
B	7.092
C	3.695
D	2.437
E	1.835
F	1.489
G	0.890

3. Provide solutions to the following problems. Justify your answers.



4. Provide reaction conditions for each of the following reactions.





5. For the series of reactions shown below:

a) Identify **A-J**. Explain each reaction briefly and cogently.

b) Interpret the spectral data in your analysis.

c) Why is more of **G** formed than **H**?

d) What is the structure of the base peak in each mass spectrum?

[Note: Compounds **D** and the compound after the first reaction on **I** are soluble in aqueous base. The font size of letters **G - I** reflects the relative yield of each compound.]

