1) (6 pt). Devise a synthesis of 3-amino-4-hydroxy-5-methoxybenzaldehyde from 4-hydroxy-3-methoxybenzaldehyde.

![Chemical structures]

2) (7 pt). Consider the nitration of fluorobenzene. Draw the cationic intermediate that results from the addition of \( \text{NO}_2^+ \) to fluorobenzene at the para-position. Draw all of resonance structures for this intermediate. Indicate which resonance structure is the most stable and also indicate why this is the case.

![Chemical structures]

This is the most stable resonance structure because every atom has a full octet.
3) (6 pt). Consider the following chlorinated compounds.

![Diagram of chlorinated compounds]

a. Rank the relative rates of these compounds expected in an electrophilic aromatic nitration reaction with 1 as fastest and 5 slowest.

b. How would the rate of toluene compare? Which of the above five compounds would be closest to toluene in rate? Toluene would have a faster rate compared to all the examples above. Substrate A would have a rate closest to toluene.

c. The difference in rates among these compounds is due to what effect? Inductive effect

4) (6 pt). Devise a synthesis of compound A from benzene and any other starting material of four carbons or less.

![Synthesis diagram]
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