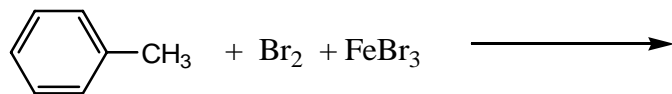


**CHEM 235 IN-CLASS PROJECT #4** (25 pts) NAMES \_\_\_\_\_

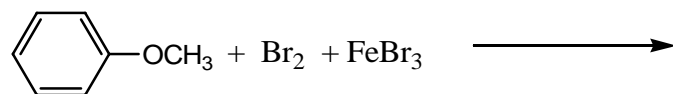
Shown below is the electrophilic aromatic substitution reaction of toluene with bromine and ferric bromide.



a. In step #1 of this reaction, note that the Br can attach at 3 different positions in relationship to the CH<sub>3</sub> group (ortho, meta or para). Depict the cation that will be produced from each different attachment. Show all pertinent resonance structures for each cation—**Circle the resonance structure(s) that are the most stable.**

b. Draw the possible reaction product(s) of this reaction. State which product would be produced in the greatest yield and lowest yield.

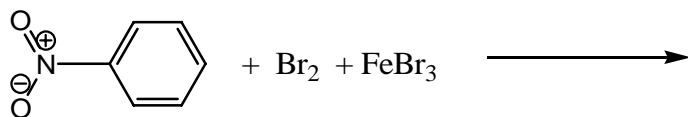
2. Shown below is the reaction of anisole with bromine and ferric bromide.



a. In step #1 of this reaction, note that the Br can attach at 3 different positions in relationship to the OCH<sub>3</sub> group (ortho, meta or para).. Depict each cation that will be produced from each different attachment. Show all pertinent resonance structures—**Circle the resonance structure(s) that are the most stable.**

b. Draw the possible reaction product(s) of this reaction. State which product would be produced in the greatest yield and lowest yield.

3. Shown below is the reaction of nitrobenzene with bromine and ferric bromide.



a. In step #1 of this reaction, note that the Br can attach at 3 different positions in relationship to the nitro group ( $\text{NO}_2$ ) (ortho, meta or para). Depict each cation that will be produced from each different attachment Show all pertinent resonance structures—**Circle the resonance structure(s) that are the most stable.**

b. Draw the possible reaction product(s) of this reaction. State which product would be produced in the greatest yield and lowest yield.

4. Rank the order of reactivity between toluene, anisole and nitrobenzene (fastest to slowest) and briefly explain why.

5. What are the 2 major products of the chlorination of the aromatic compound shown below. Briefly explain your answer.

