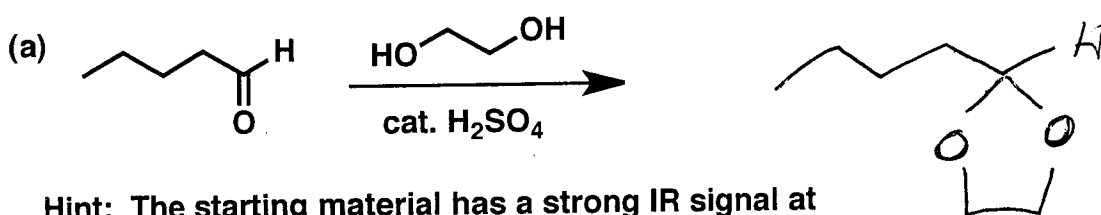


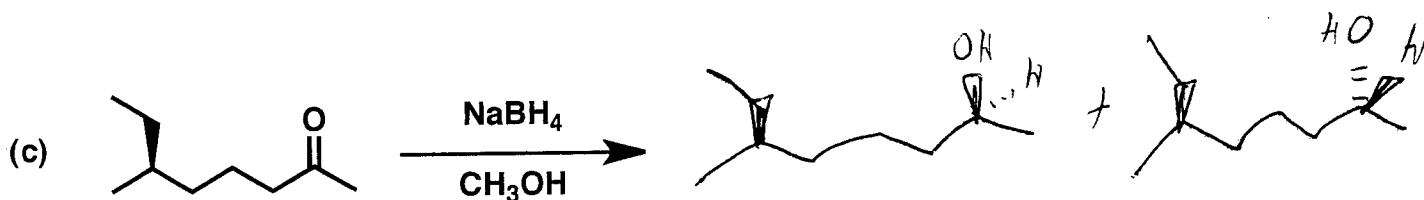
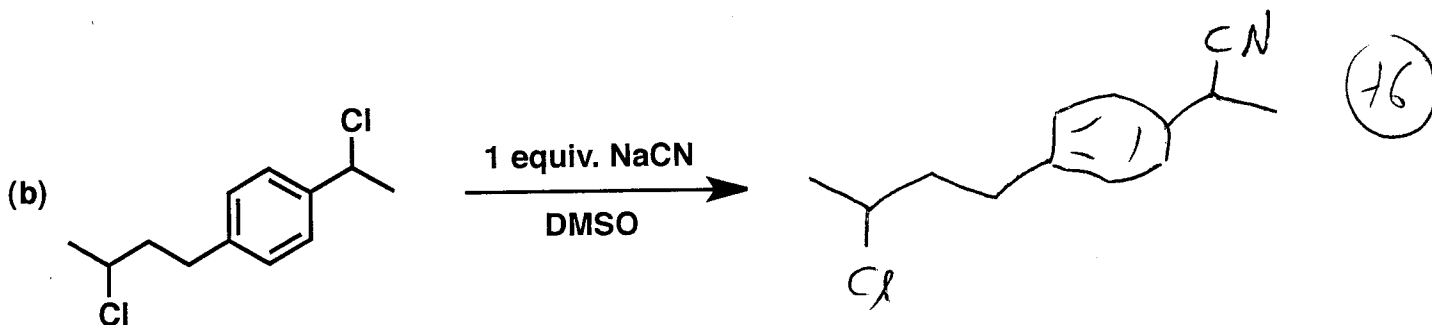
General Instructions:

- (i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit.
- (ii) Print your name on each page.

1. (20 points) Show the major product or products expected from each reaction:

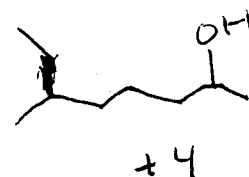


Hint: The starting material has a strong IR signal at 1720 cm⁻¹, but there is no such signal in the product.



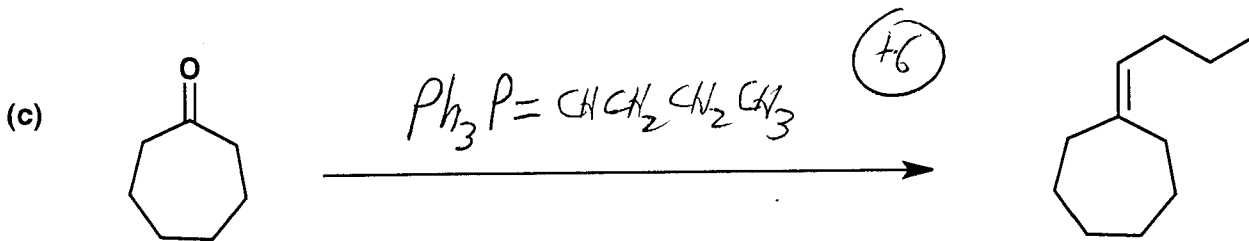
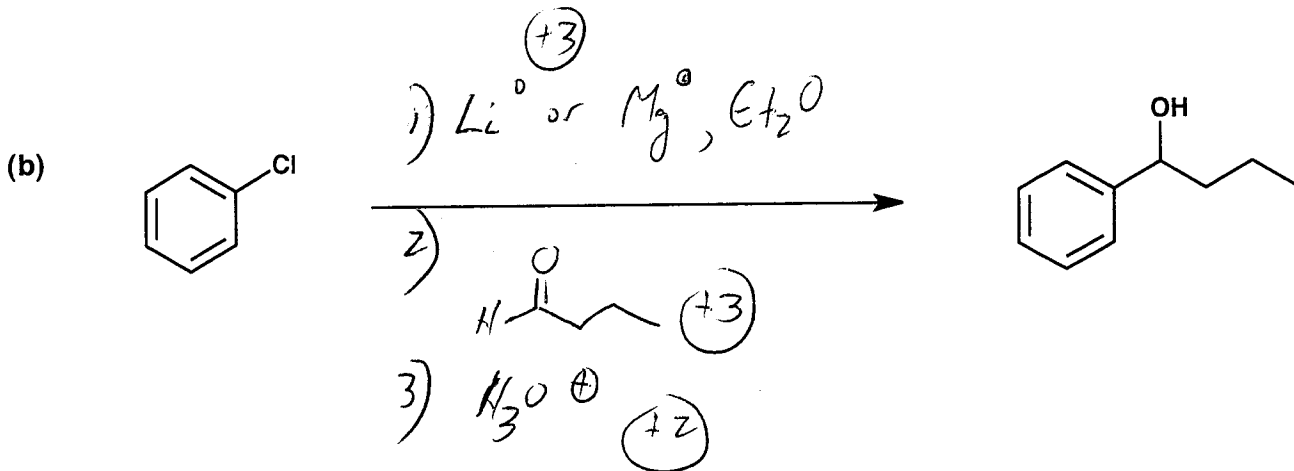
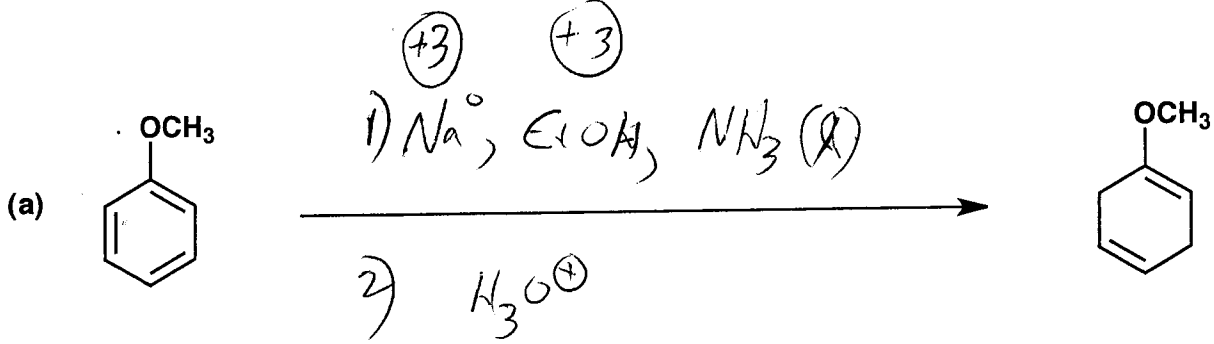
Note: The starting material is a single enantiomer.

+6 for one,
or +8 for both



Name _____

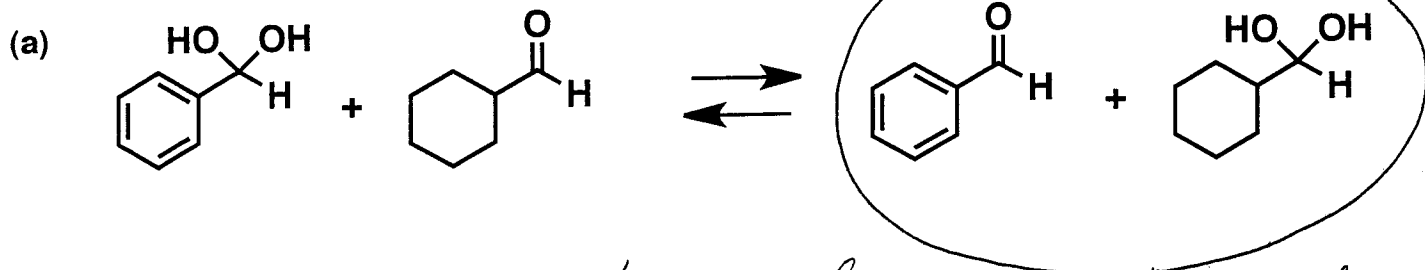
2) (20 points) Show the reagents and other organic molecules required to convert the



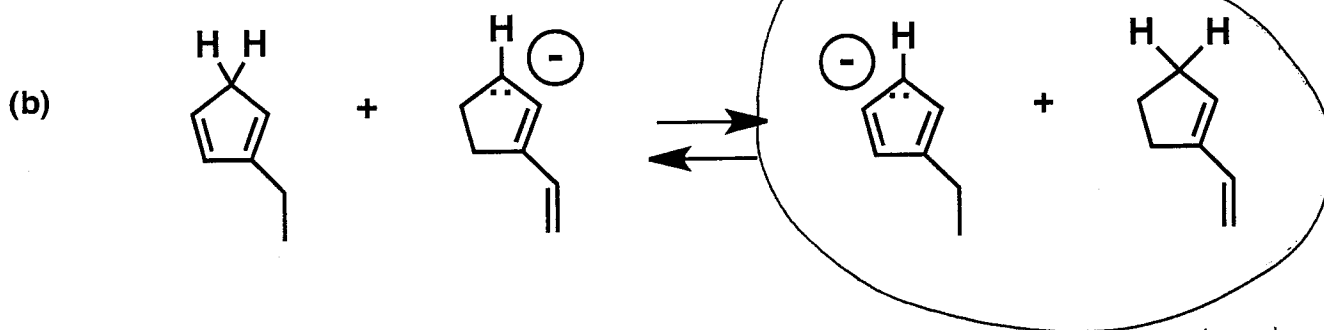
+1 for correct circle
+6 for correct explanation

Name _____

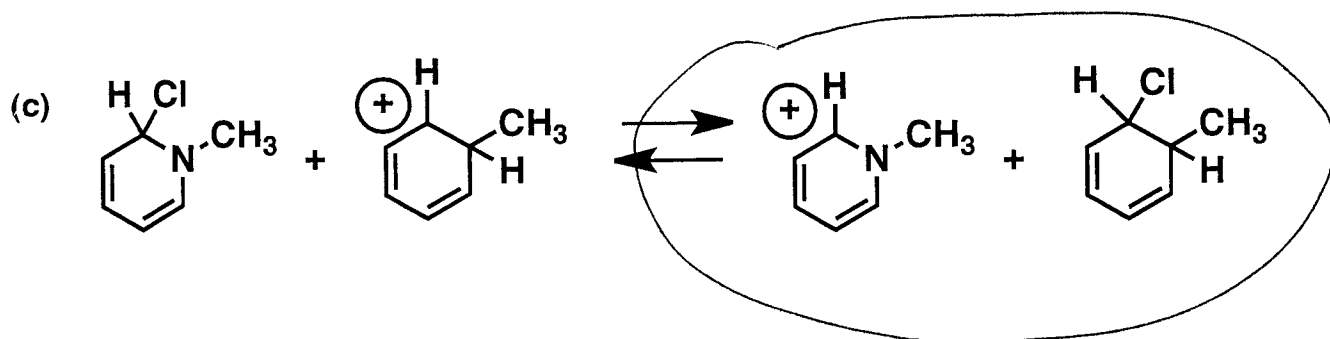
3. (21 points) For each equilibrium below, CIRCLE the side that you expect to be favored. (Do not worry about the mechanism of interconversion.) Briefly explain your reasoning.



The carbonyl is stabilized by an adjacent aromatic group, relative to an alkyl unit, because of delocalization of δ^+ on carbonyl carbon.



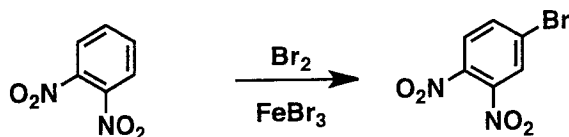
The anion on this side is aromatic (but not the other anion).



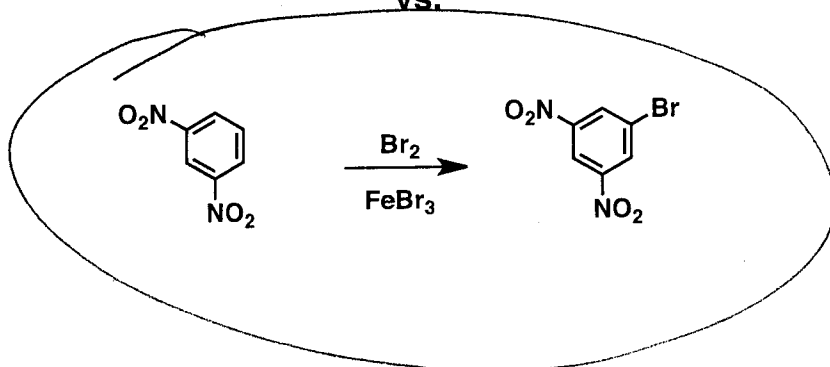
The cation on this side is aromatic (but not the other cation).

4. (cont.)

(b) Of the two reactions shown below, CIRCLE the one that you expect to occur MORE RAPIDLY. Briefly explain your reasoning (you can use structural drawings in your explanation).



VS.

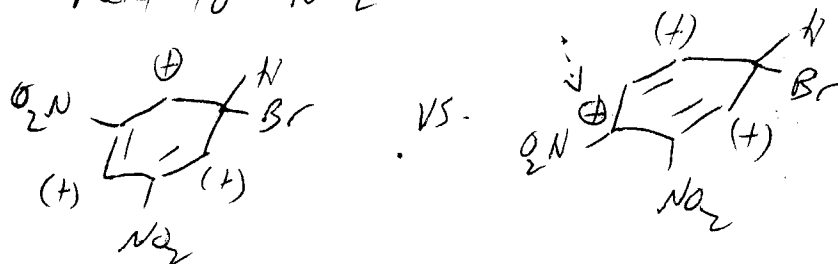


+1 for correct circle

both meta directors +3

① Formation of the cationic intermediate is the rate-determining step. (+3)

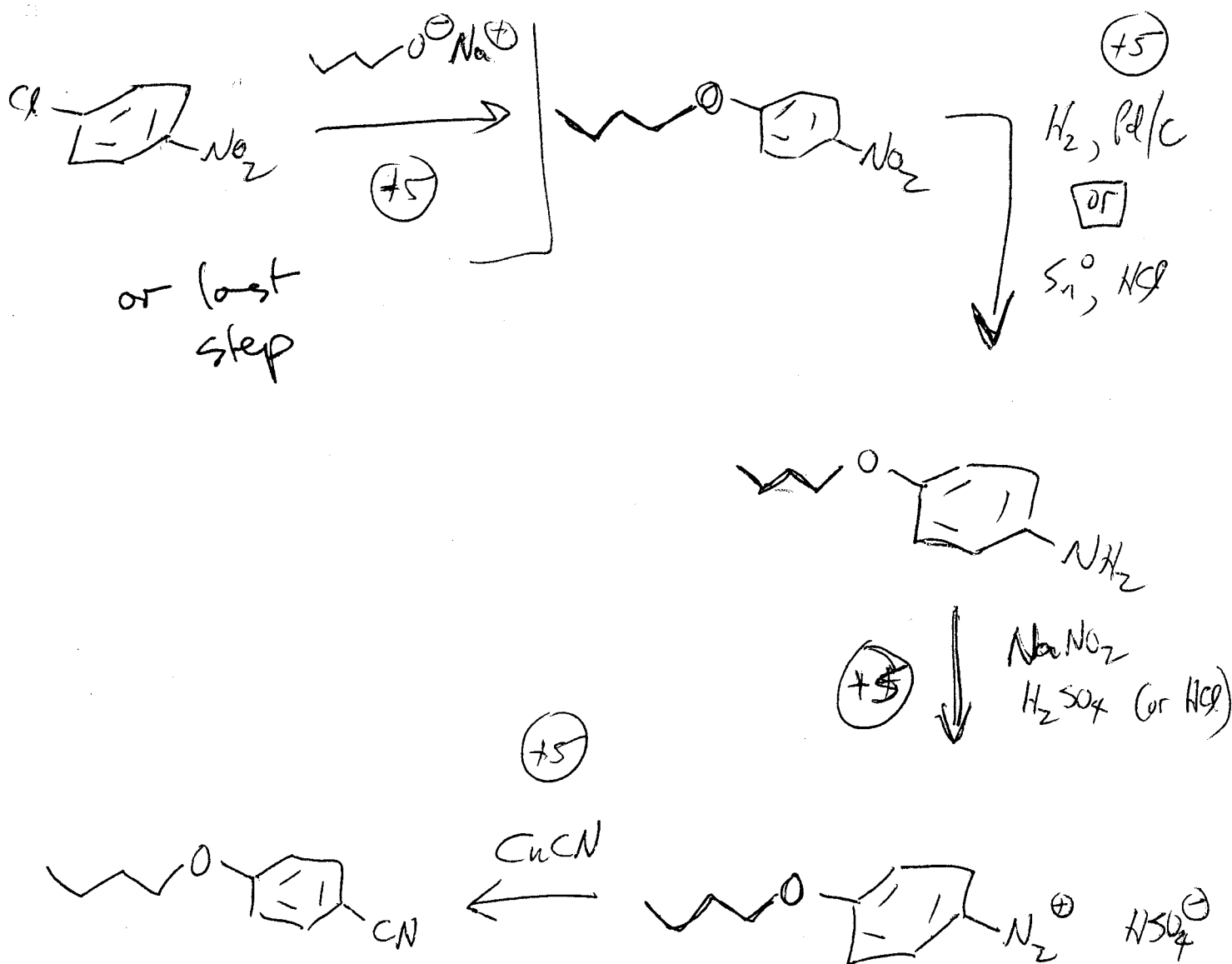
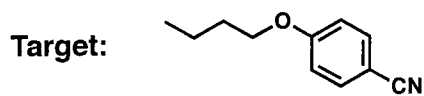
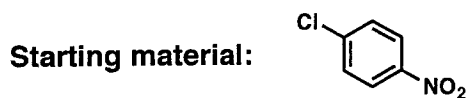
② The cationic intermediate for the indicated reaction should be more stable than for the other, because ⊕ does not "resonate" next to NO₂ in the indicated case (+3)



③ Structures of rate-determining transition states should be similar to structures of cationic intermediates. More stable TS → faster reaction. (+3)

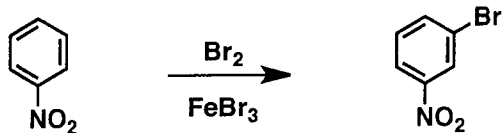
Name _____

5. (20 points) Propose a synthesis of the target molecule from the indicated starting material and any other materials. Try to identify a route that has as few steps as possible.



4. (19 points)

(a) Draw out a mechanism ("curved arrows") for the reaction shown below. Be sure to show all important resonance structures in intermediates.

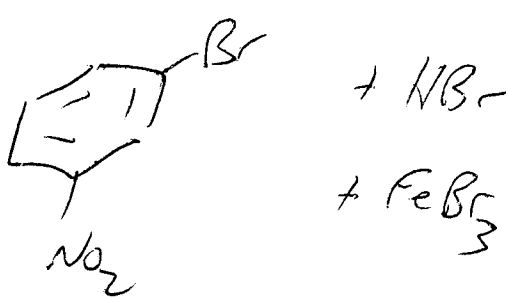
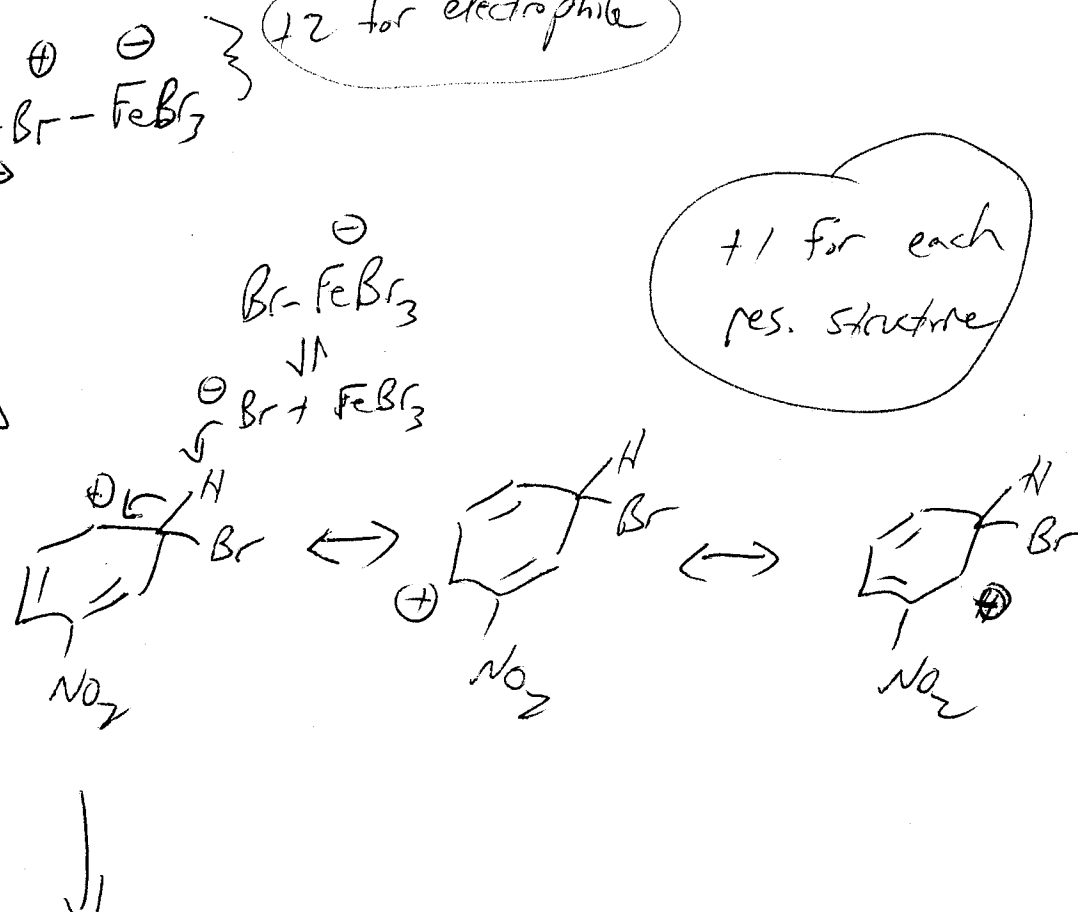


+2 for arrows

+2 for electrophile

+1 for each res. structure

+2 for arrows



+9 total