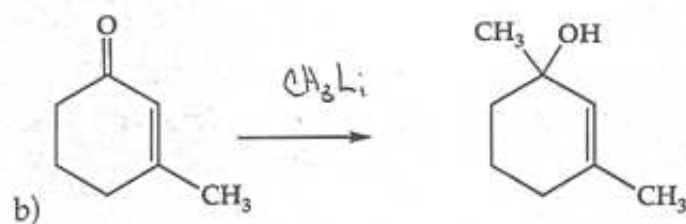
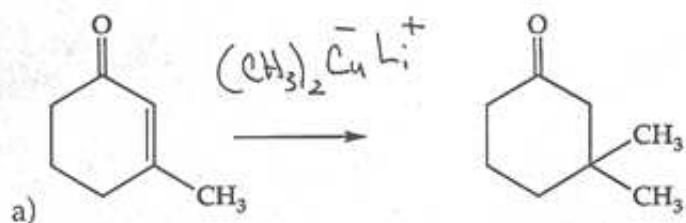
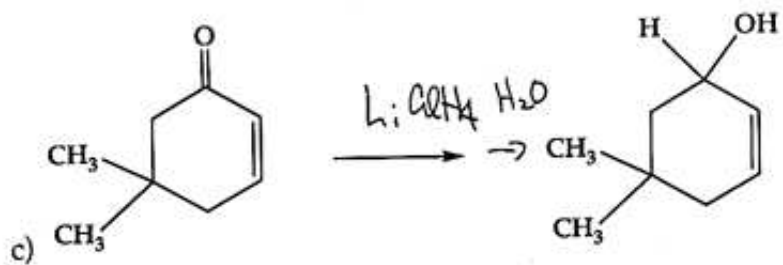


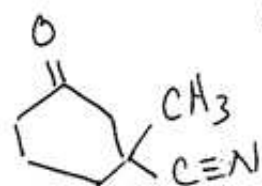
Name: Key (please print)

1. (20 pts) Show how each of the following conversions can be accomplished.



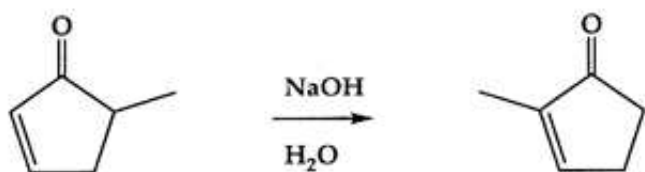


$\downarrow$ 
  
 ACN
   
 dilute  $\text{H}^+$

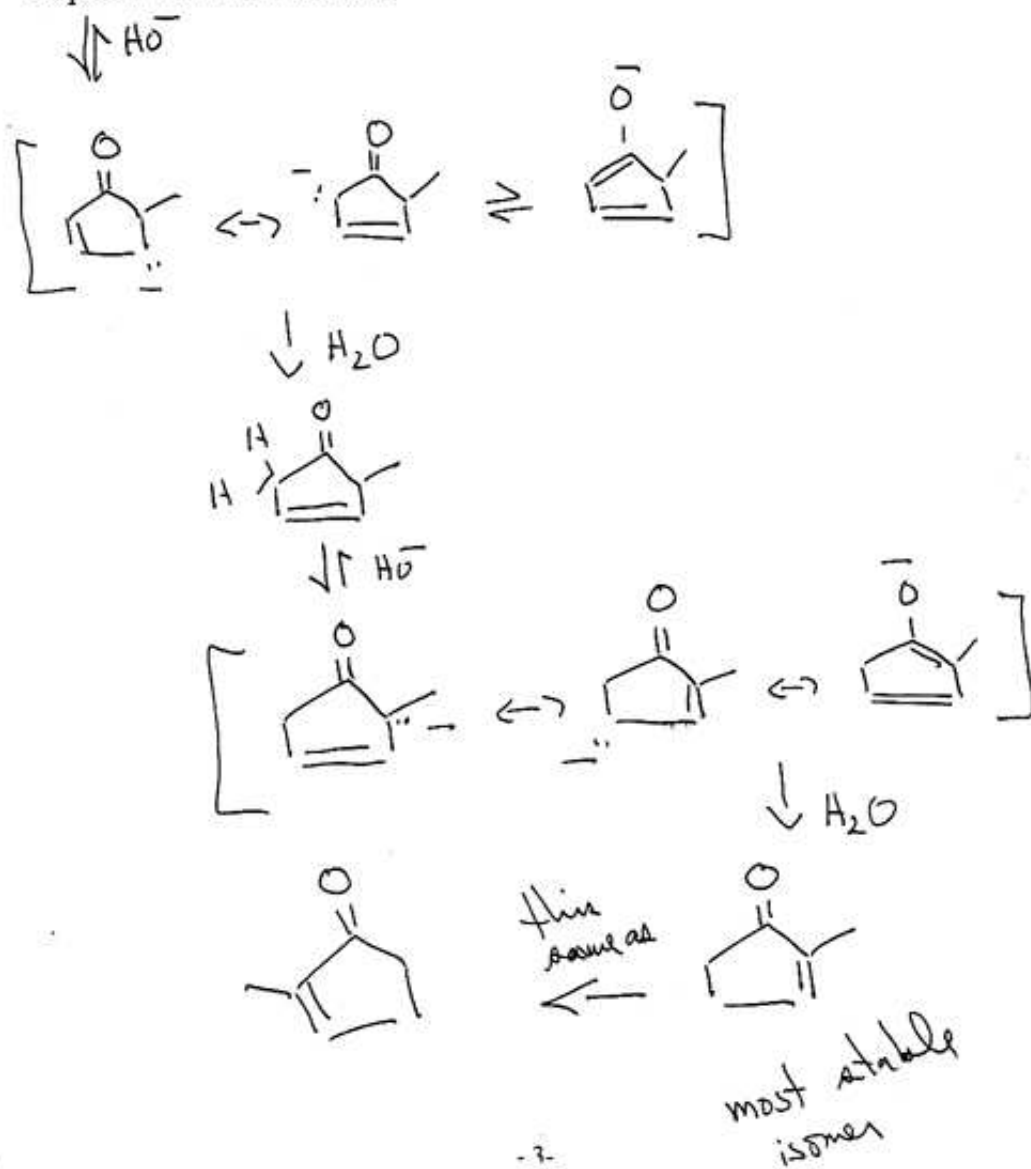


$\nearrow$ 
  
 $\text{H}_2\text{SO}_4$ 
  
 $\text{H}_2\text{O}$ 
  
 $\Delta$

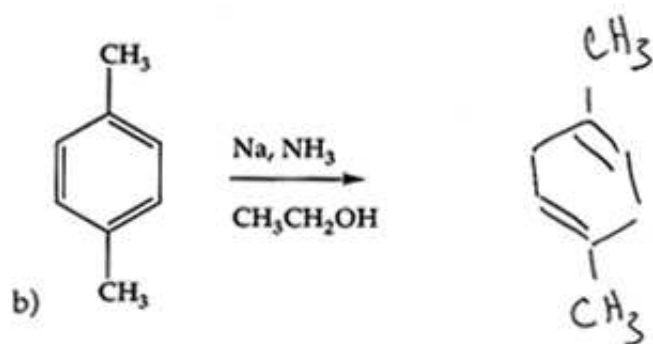
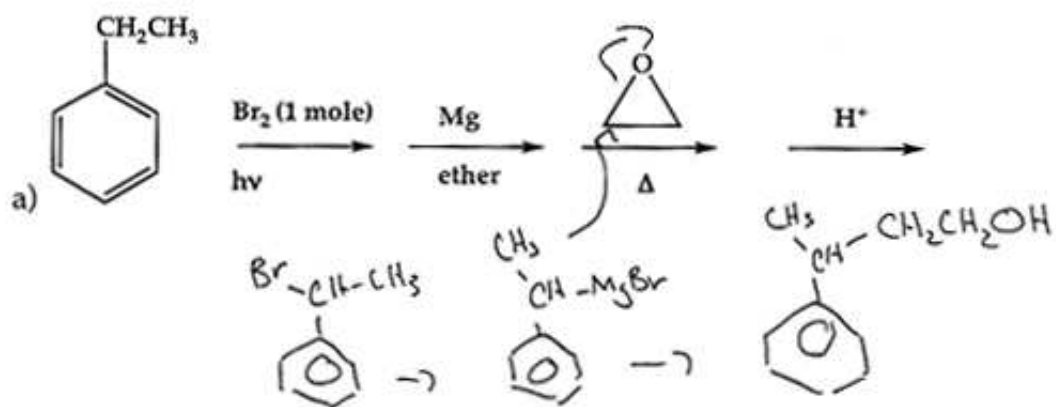
2. (10pts) 5-Methylcyclopent-2-en-1-one reacts with refluxing aqueous sodium hydroxide to give 2-methylcyclopent-2-en-1-one.

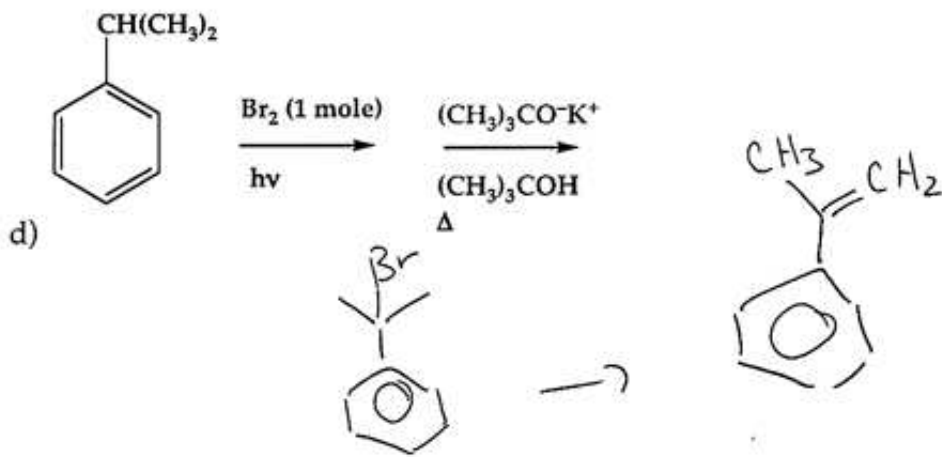
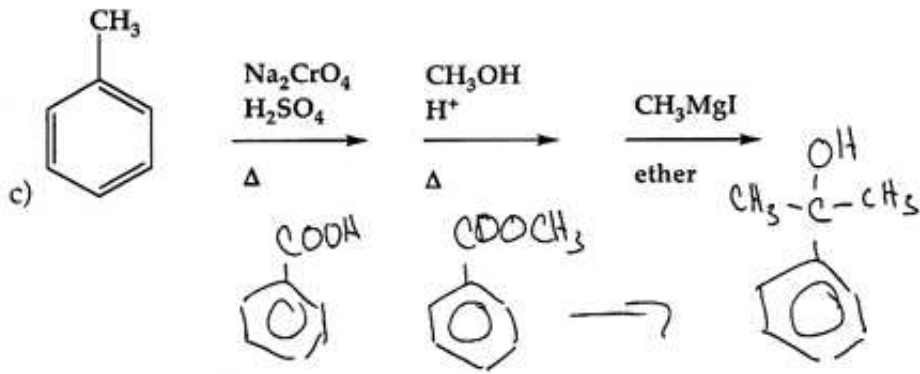


Explain with a mechanism.

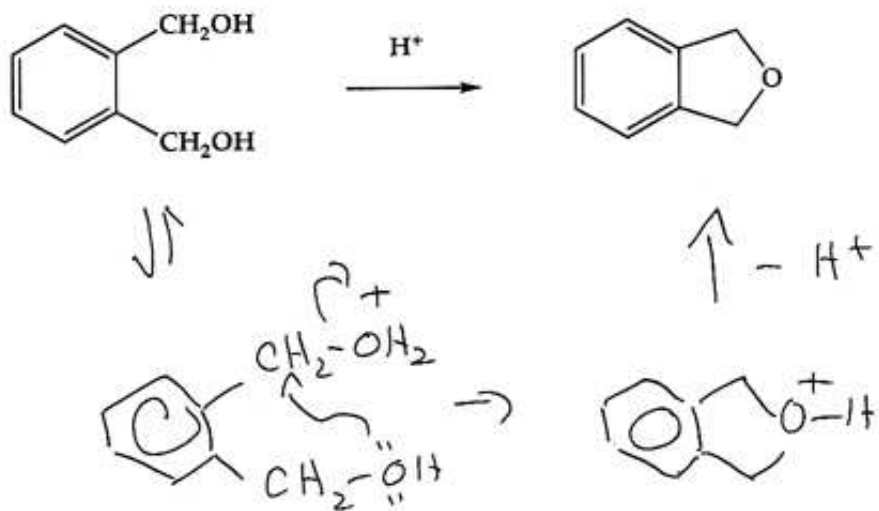


3. (20 pts) Give the principal product of the following reactions or reaction sequences.

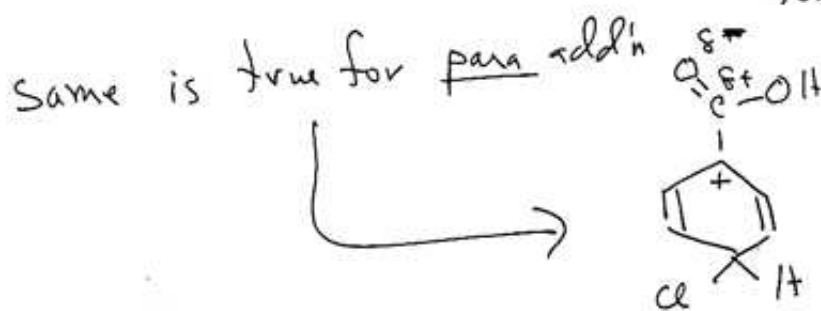
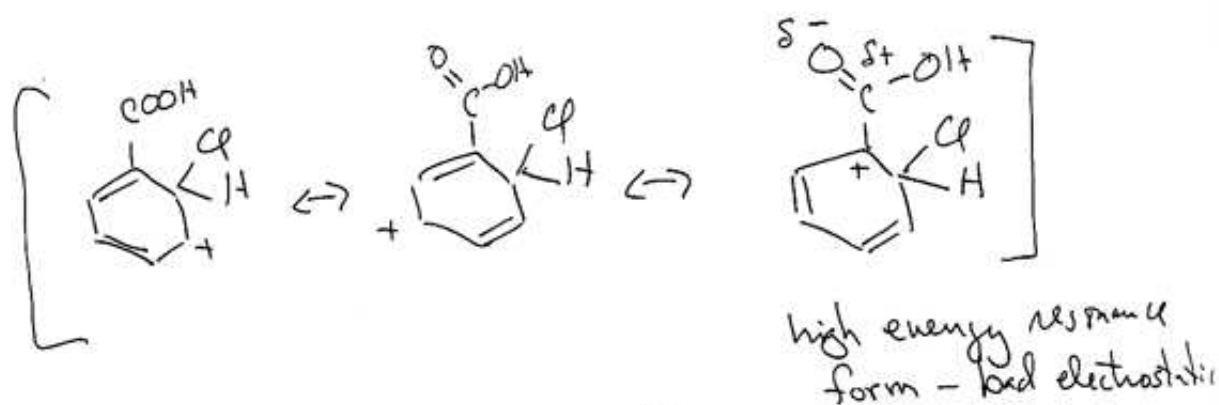
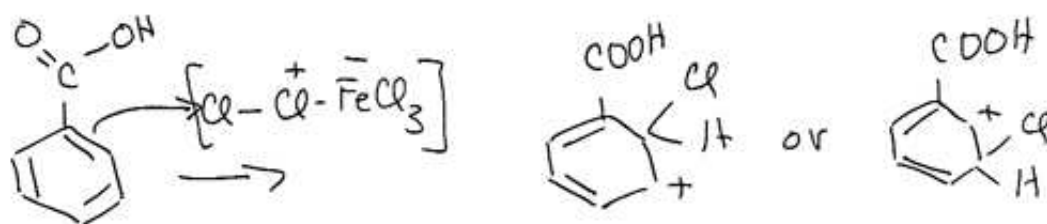
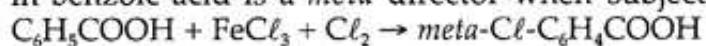




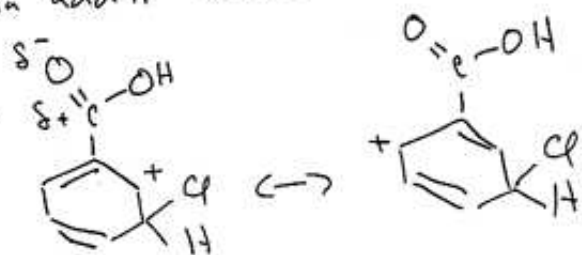
4. (10 pts) Give a reasonable mechanism for this reaction.



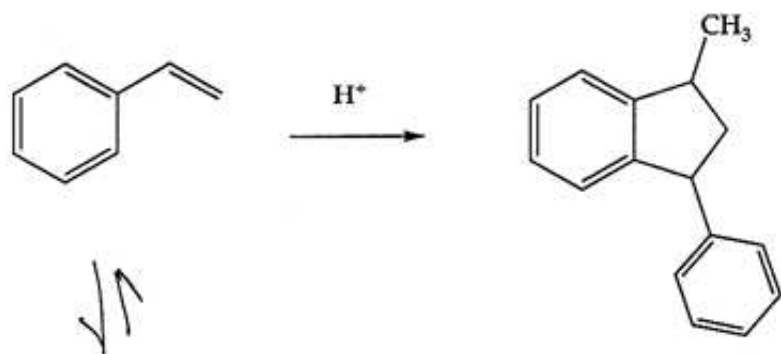
5. (10 pts) Use resonance structures to show why the COOH group in benzoic acid is a *meta* director when subjected to chlorination.



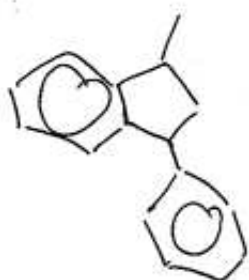
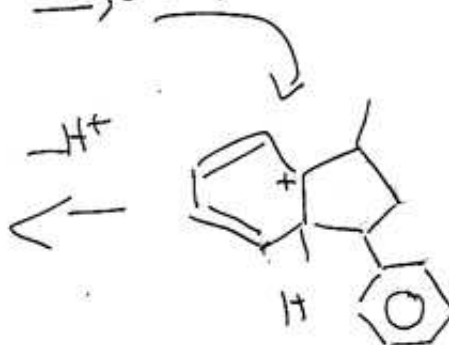
meta add'n avoids this — no buildup of plus charge  $\alpha$  to carboxyl.



6. (10 pts) On heating in  $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$ , styrene reacts to form a dimer in good yield. Write a reasonable mechanism.



add in ortho to alkyl group



7. (20 pts) Show how the following can be prepared from benzene or toluene.

