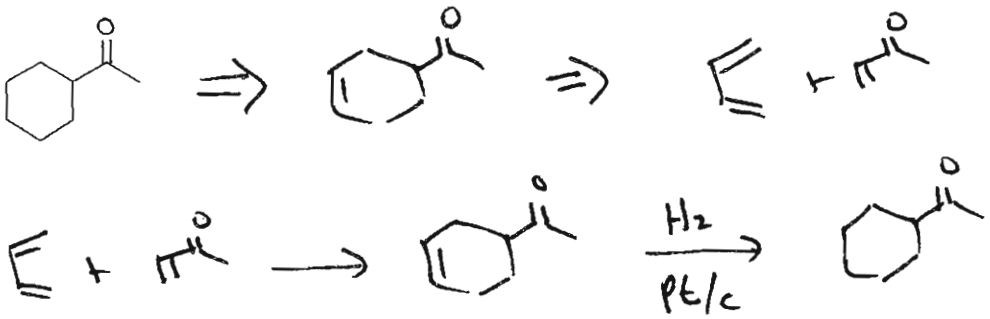
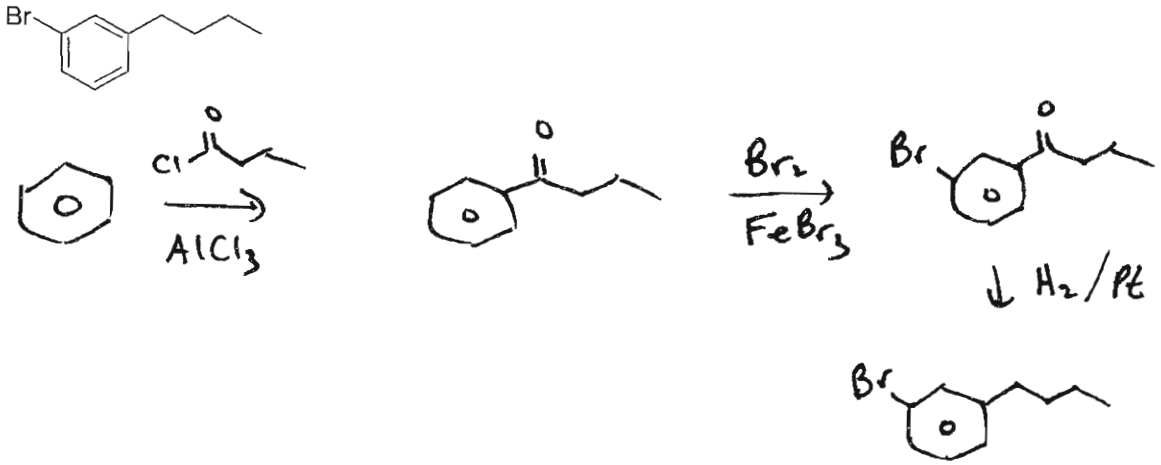
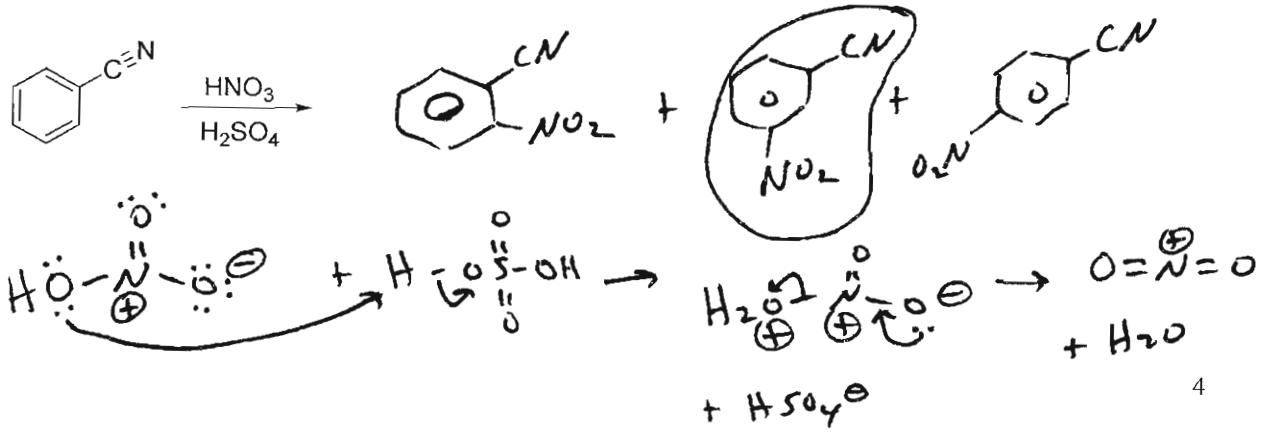
6. (10 points) Provide a synthesis for the following compound. You may begin with any organic reagents containing four carbons or less and any inorganic reagents you need.




7. (10 points) Provide a synthesis for the following compound. You may use organic reagents of 4 carbons or less, benzene, and any inorganic reagents you need.

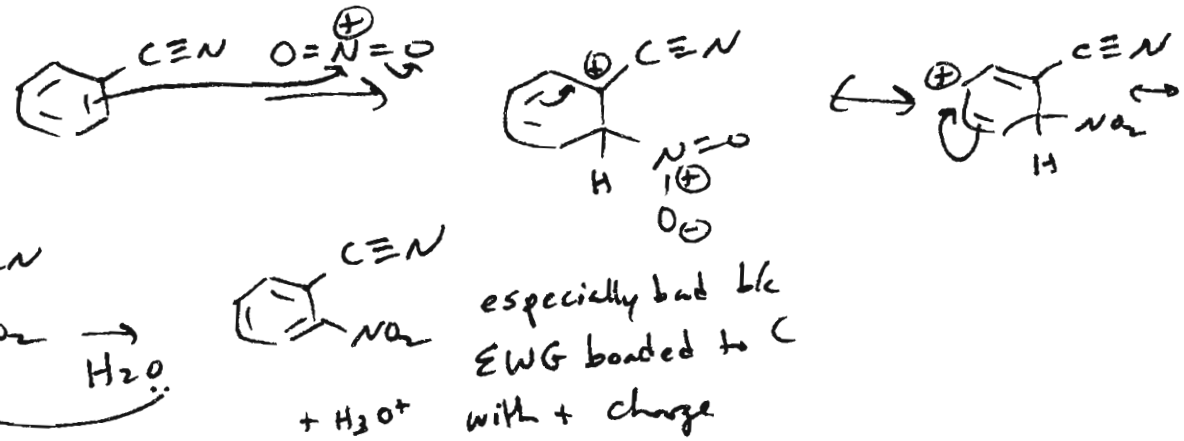



8. (20 points) Show the ortho, meta, and para substitution products for the following electrophilic aromatic substitution reaction. Circle the major product(s). Provide a complete electron pushing mechanism for <u>each</u> of the three products, including formation of the active electrophile, and briefly explain how your mechanism supports your conclusion as to which product(s) will predominate. Resonance structures for the intermediates are recommended as part of your explanation. You may continue your answer on the next page.



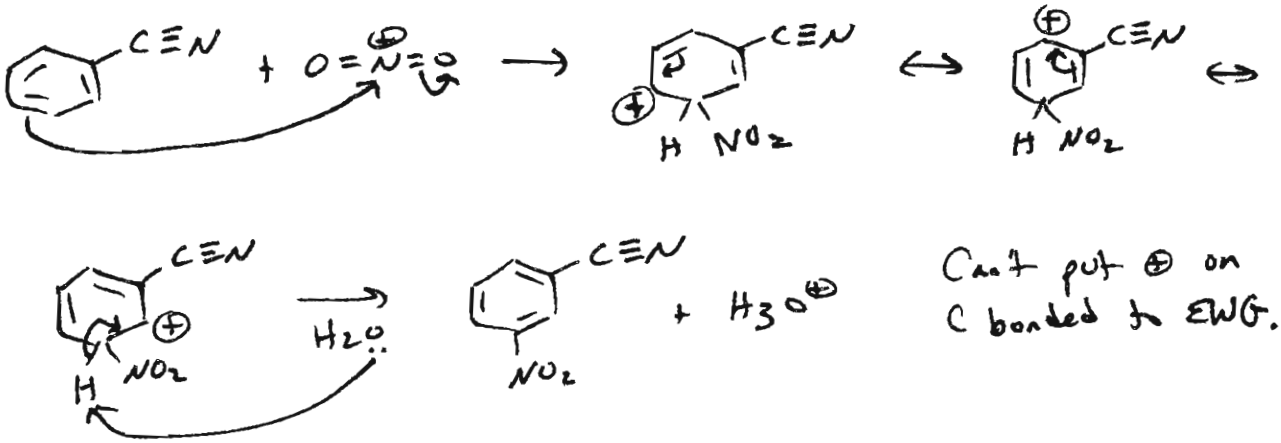
Intentionally blank for #8.

ortho



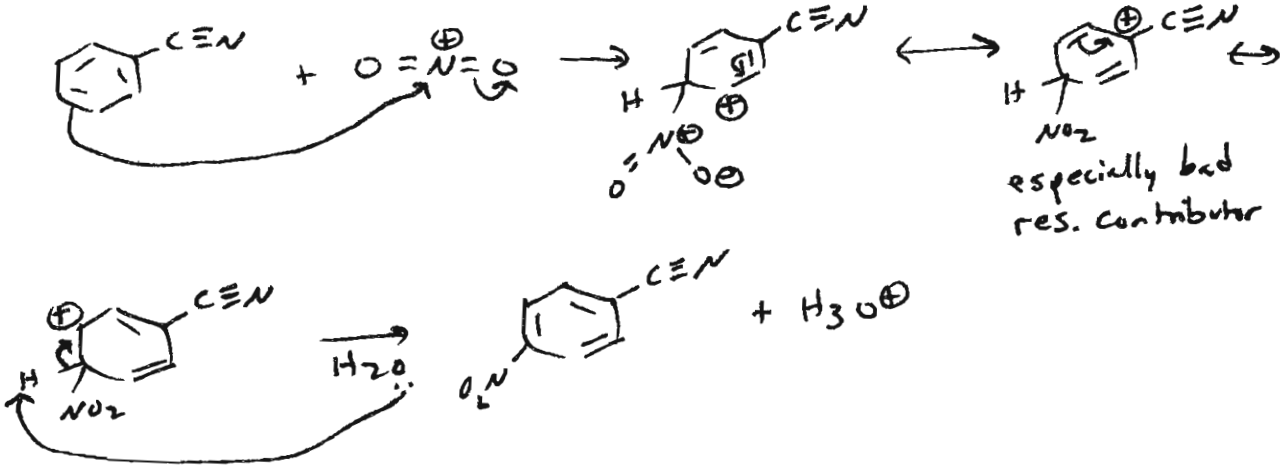

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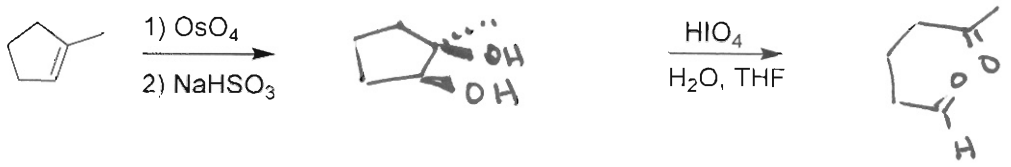
meta

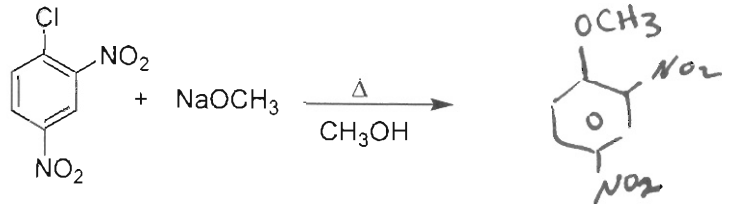


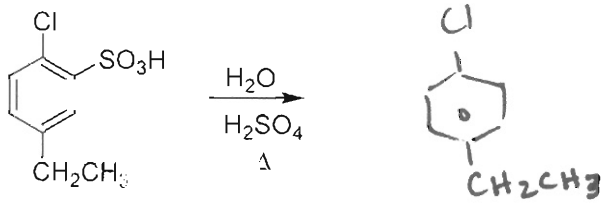

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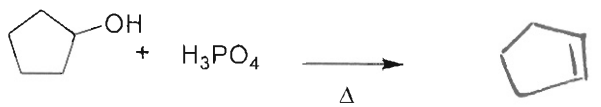
para

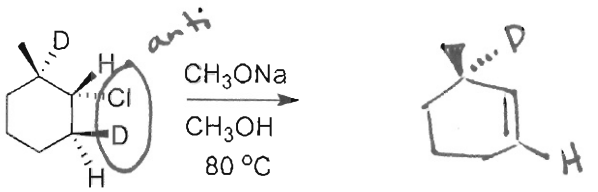


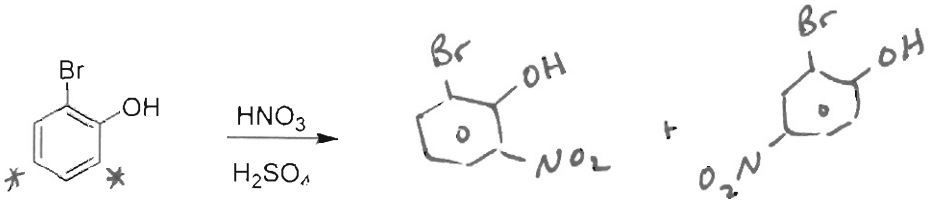

1) $OsO_4$
2) $NaHSO_3$
OH
OH
$HIO_4$
$H_2O$, THF
O
O
H


Cl
$NO_2$
+ $NaOCH_3$
Δ
$CH_3OH$
$NO_2$
$OCH_3$
$NO_2$
O
$NO_2$

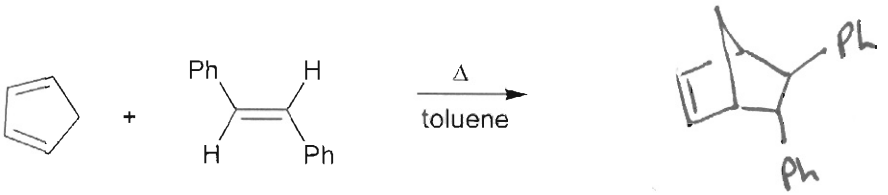

Cl
$SO_3H$
$CH_2CH_3$
$H_2O$
$H_2SO_4$
Δ
Cl
O
$CH_2CH_3$

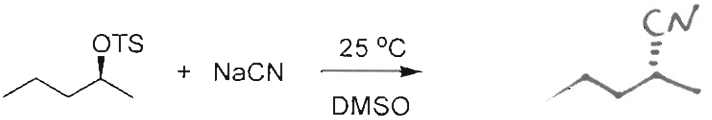

OH
+ $H_3PO_4$
Δ

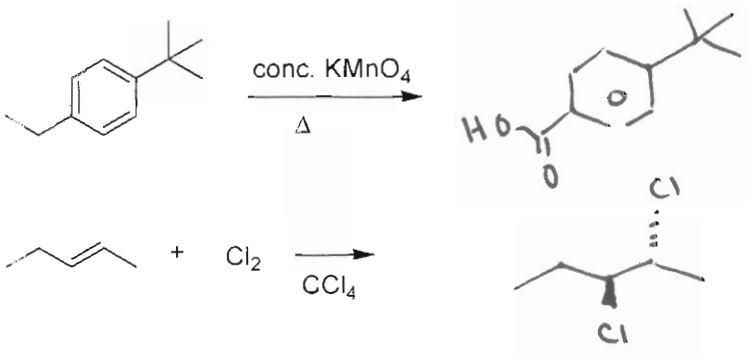

D
H
Cl
D
H
anti
$CH_3ONa$
$CH_3OH$
80 °C
D
H


Br
OH
*
*
$HNO_3$
$H_2SO_4$
Br
OH
O
$NO_2$
+
Br
OH
O
$O_2N$

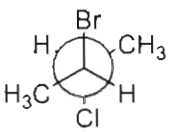

$CH_3C{\equiv}CH$ + 2HBr
$CH_3\ CBr_2\ CH_3$

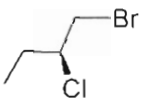

+
Ph
H
H
Ph
Δ
toluene
Ph
Ph


OTS
+ NaCN
25 °C
DMSO
CN

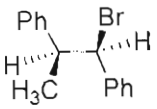


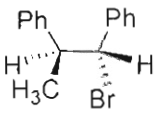

18. (12 points, 4 each) Determine if each of the following pairs of compounds represent enantiomers, diastereomers, constitutional isomers. or two molecules of the same compound.



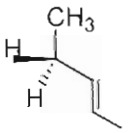



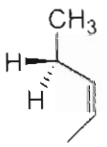

constitutional isomers



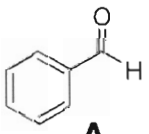

same



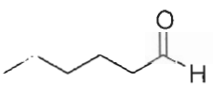




diastereomers

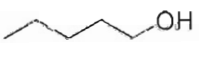
19. (10 points) Match each of the given IR spectra to one the following compounds. Label <u>at least one</u> peak in each IR spectrum that allows you to conclusively match spectrum to compound.



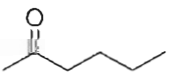

A



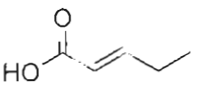

B



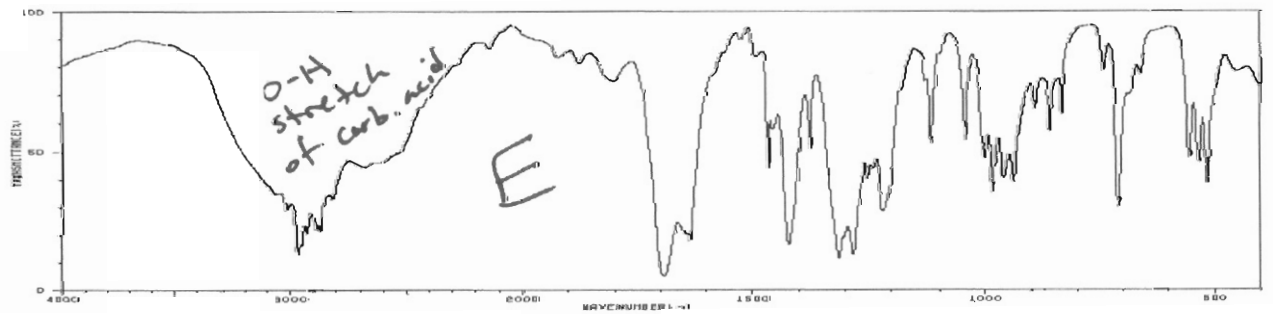

C



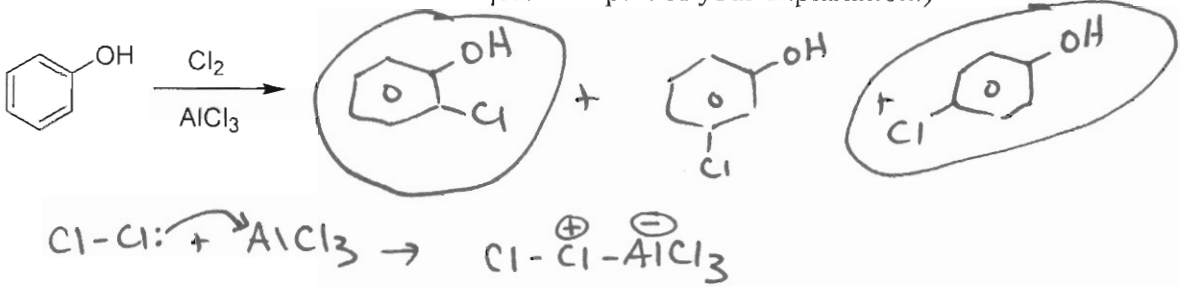

D




E



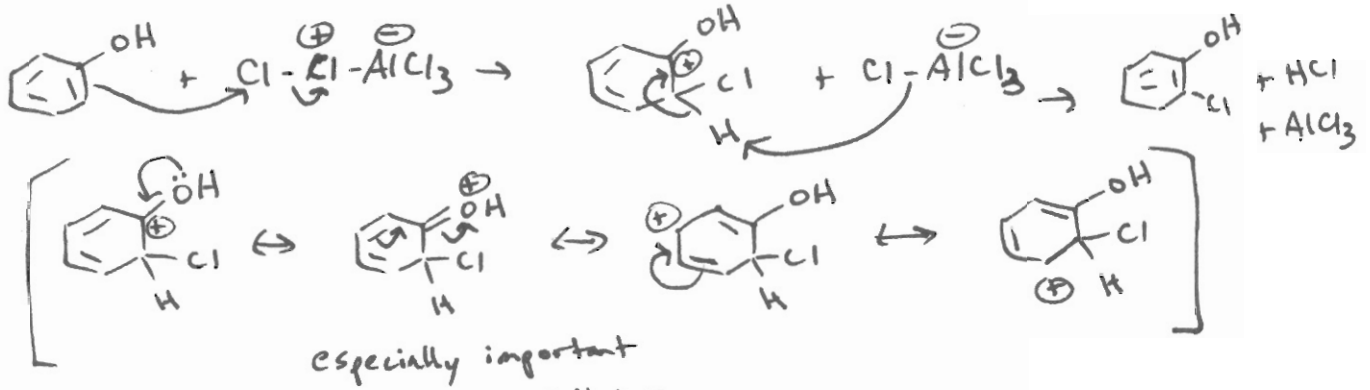
21. (20 points) Show the ortho, meta, and para substitution products for the following electrophilic aromatic substitution reaction. Circle the major product(s). Provide a complete electron pushing mechanism for each of the three products and briefly explain how your mechanism supports your conclusion as to which product(s) will predominate. (Resonance structures for the intermediates are required as part of your explanation.)



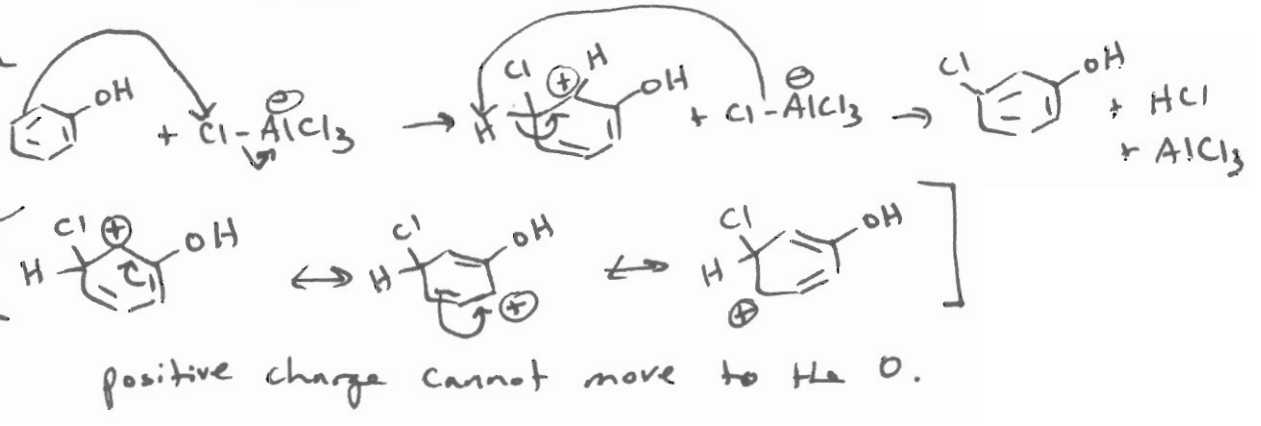




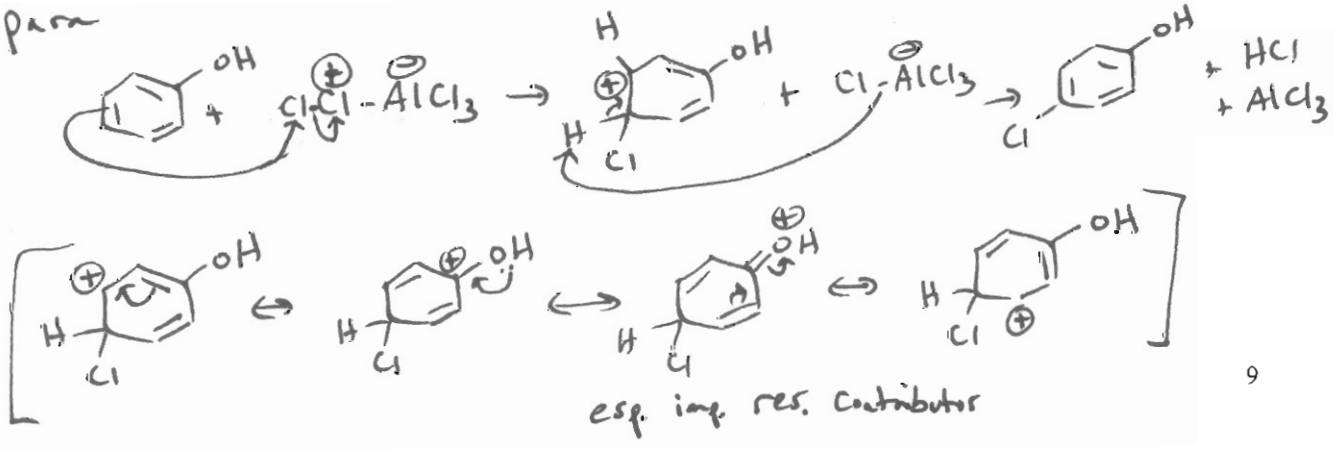
ortho




meta

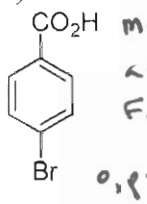



para



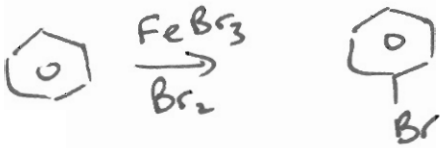
23. (20 points, 10 each) Provide a synthesis for two out of three of the following compounds from benzene and any other reagents you need. More than one step will be necessary. Clearly indicate which problem you are omitting.

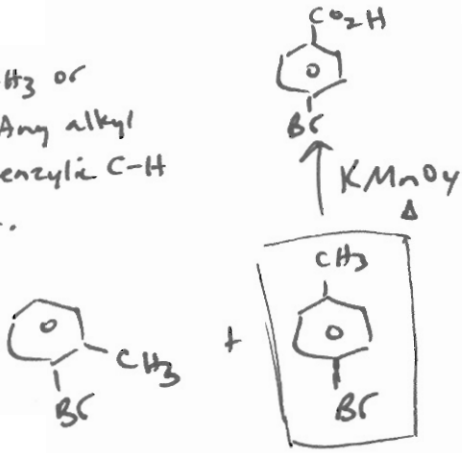
a)



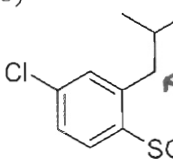

meta-directing
added a C so
Friedel-Crafts rxn
o,p-directing

Notes:
Can add $CH_3$ or Br first. Any alkyl group w/ benzylic C-H will work.



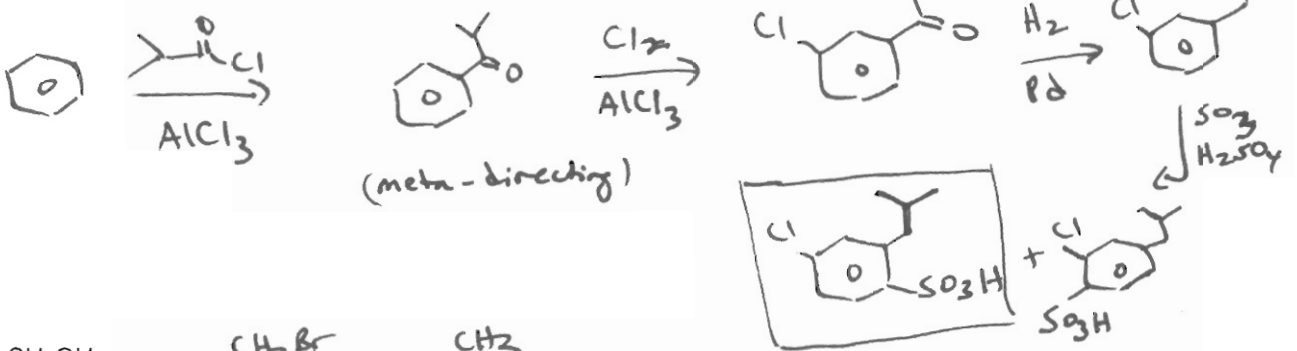




b)



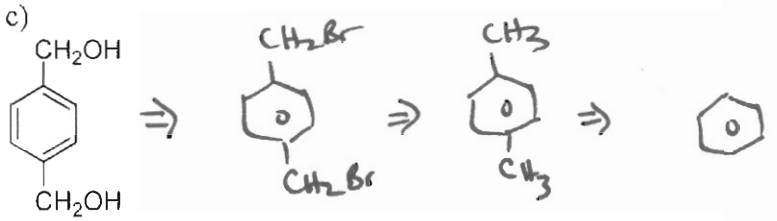

must do acylation b/c it would rearrange during alkylation (1° R-X)

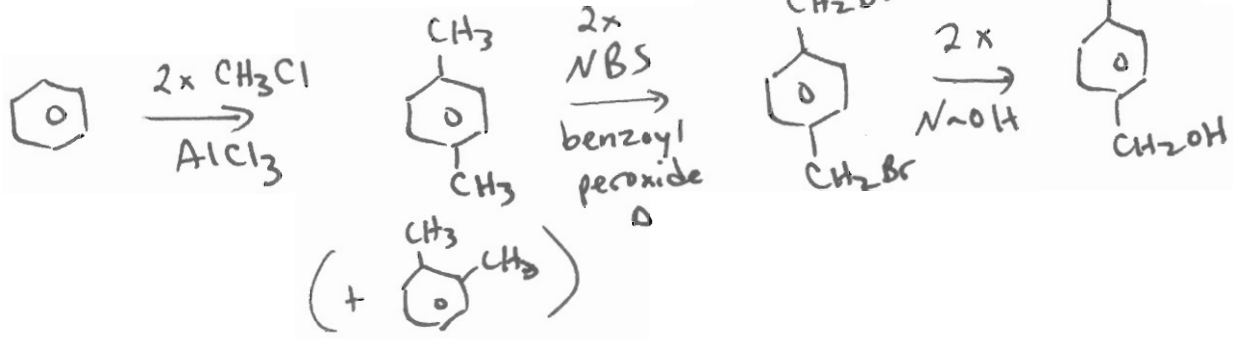
↑ must add after F-C rxn b/c too deactivating



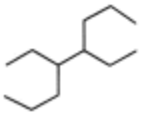

(meta-directing)

c)

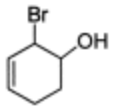


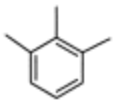
1. (12 points) Provide IUPAC accepted names for the following compounds.



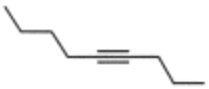
4,5-diethyloctane



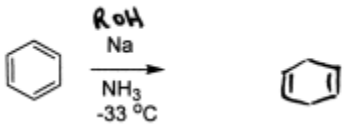

2-bromo-3-cyclohexene

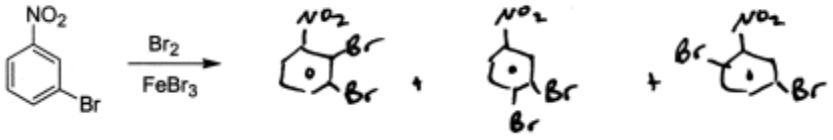


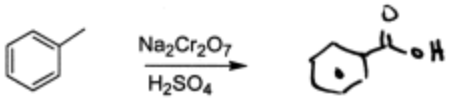
1,2,3-trimethylbenzene

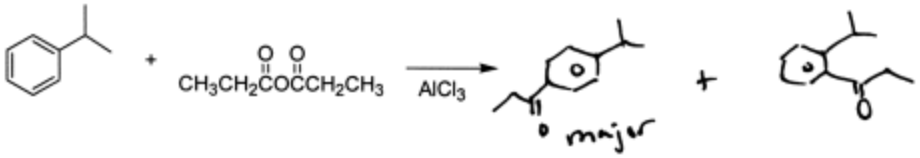


4-nonyne




23. (8each, 16points) Provide a synthesis for each of the following compounds from benzene. You may use any additional reagents you wish. More than one step may be necessary.

