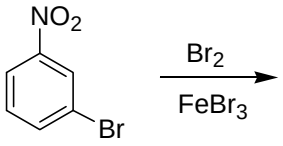
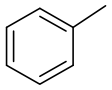
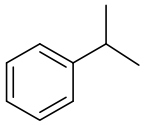
1. Provide the major organic products for the following reactions.



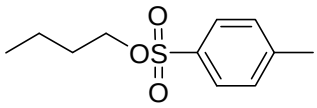
$\xrightarrow[FeBr_3]{Br_2}$



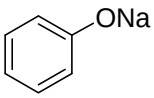
$\xrightarrow[H_2SO_4]{Na_2Cr_2O_7}$



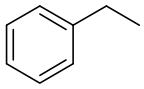
+ $CH_3CH_2\overset{O}{\overset{\|}{C}}O\overset{O}{\overset{\|}{C}}CH_2CH_3$ $\xrightarrow{AlCl_3}$



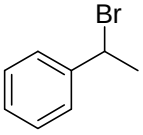
+

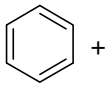


$\longrightarrow$

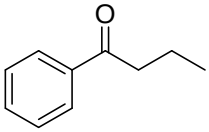


+ $\longrightarrow$

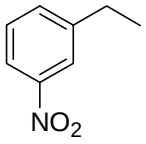




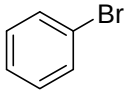
+ $\longrightarrow$



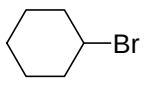
$\xrightarrow[KOH]{H_2NNH_2}$ Δ



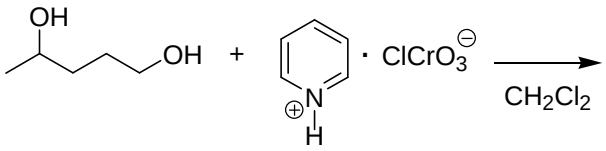
+ $Br_2/FeBr_3$ $\longrightarrow$

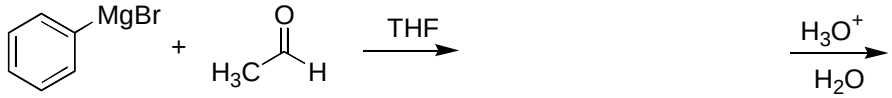


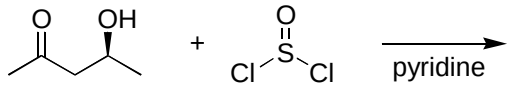
$\xrightarrow[2)\ \triangle O]{1)\ Li,\ Et_2O}$

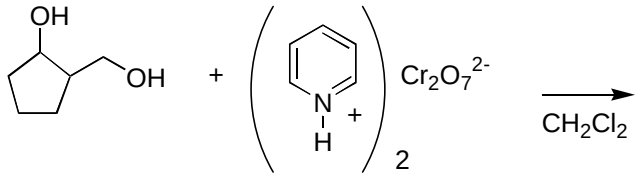


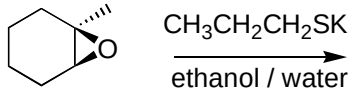
$\xrightarrow[2)\ O]{1)\ Mg,\ Et_2O}$ 3) H_3O^+

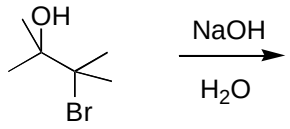

OH
OH
+
N
H
· ClCrO3
CH2Cl2

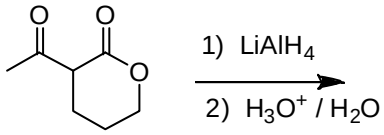

MgBr
+
O
H3C
H
THF
H3O+
H2O

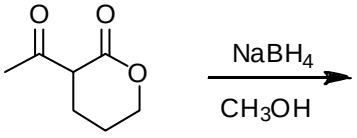

O
OH
+
O
S
Cl
Cl
pyridine


OH
OH
+
N
H
+
Cr2O7 2-
2
CH2Cl2

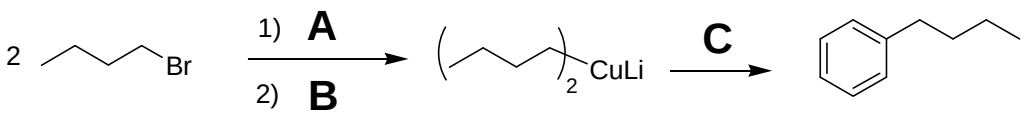

O
CH3CH2CH2SK
ethanol / water


OH
Br
NaOH
H2O

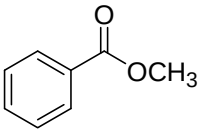

O
O
O
1) LiAlH4
2) H3O+ / H2O

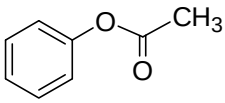

O
O
O
NaBH4
CH3OH

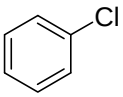
2. (6 points) What are the missing reagents A-C in the following reaction sequence?



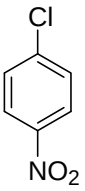
3. (3 points) Rank the following aromatic compounds by rate of reaction for electrophilic aromatic substitution. Clearly indicate which compound reacts the fastest.

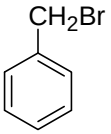


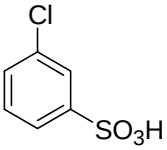


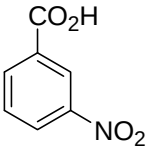


4. (8each, 16points) Provide a synthesis for each of the following compounds from benzene. You may use any additional reagents you wish. More than one step may be necessary.





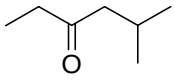


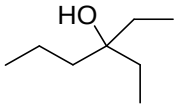


5. (10 points) Provide a reasonable synthesis of 3-heptanone. *You may look up how to name ketones.* You may use any organic reagents of <u>three carbons or less</u> and any inorganic reagents you need. If you choose to use organometallic reagents, show how they would be synthesized.

6. (6 points) Briefly explain why the Williamson ether synthesis is a better method for preparing ethyl propyl ether than the acid-catalyzed condensation of alcohols.

7. (20 points, 10 each) Provide a reasonable synthesis for the following compounds. You may use any organic reagents of <u>three carbons or less</u> and any inorganic reagents you need. If you choose to use organometallic reagents, show how they would be synthesized. (Could you do it from hydrocarbons?)





8. Provide a complete electron-pushing mechanism for the following reaction.

