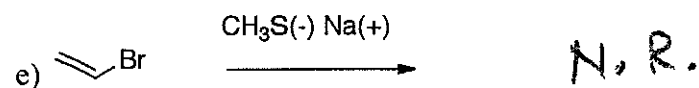
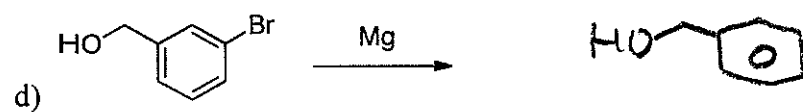
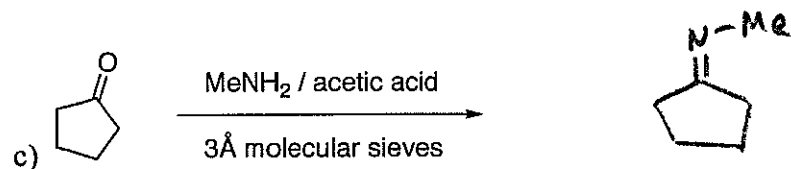
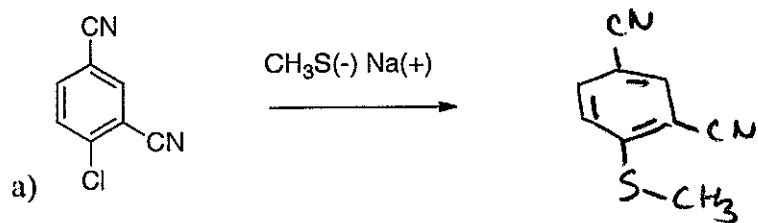
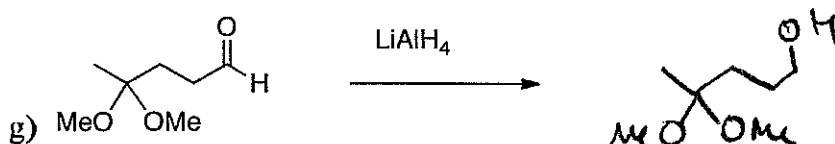
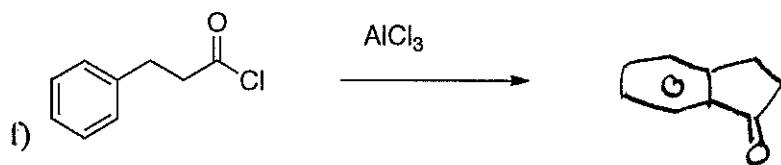
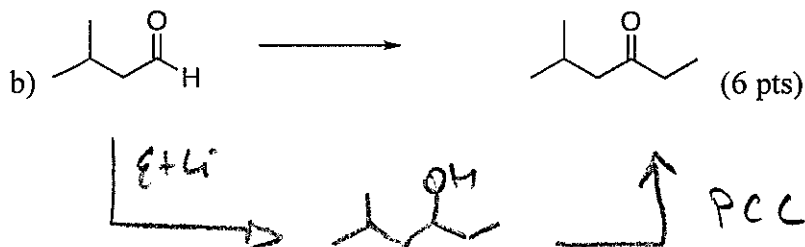
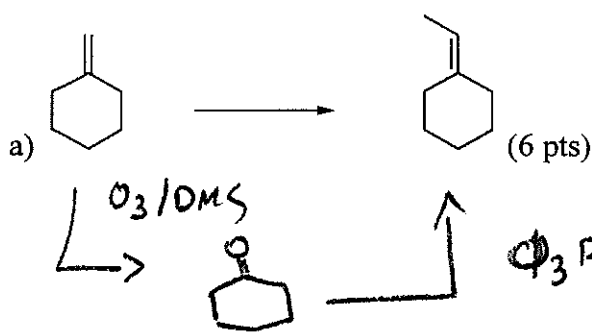


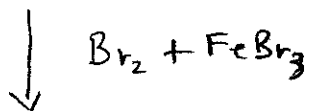
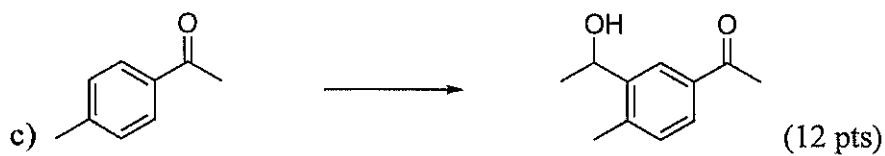
1 Provide the products of the following reactions (all reactions have an appropriate aqueous work up). If no reaction would occur, write NR. If a reaction would produce stereoisomers, draw the isomers and indicate if they will be produced in equal or unequal amounts (3 pts each).



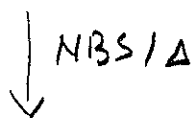
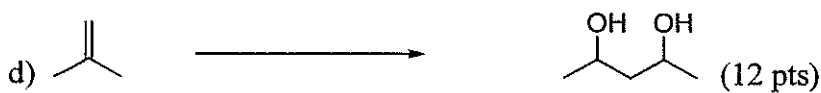
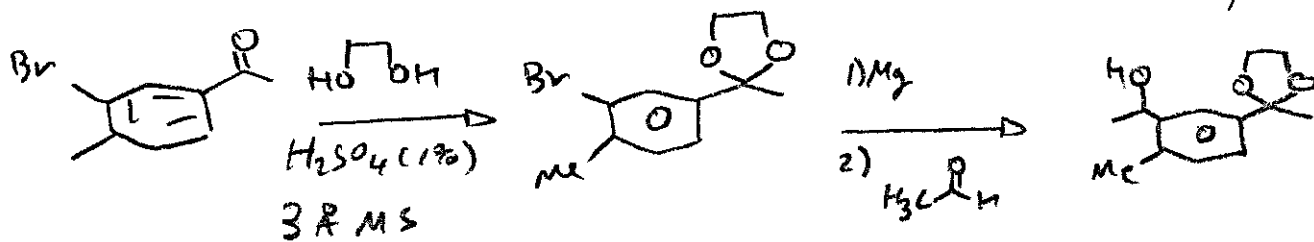


2) Complete the following syntheses using any reagents you need. You do not have to show the synthesis of the reagents you use, but you must use the starting material indicated. If your synthesis requires more than one step, provide the product after each step. All chiral products are racemic mixtures.

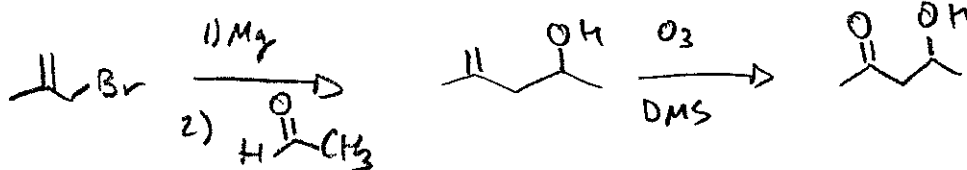




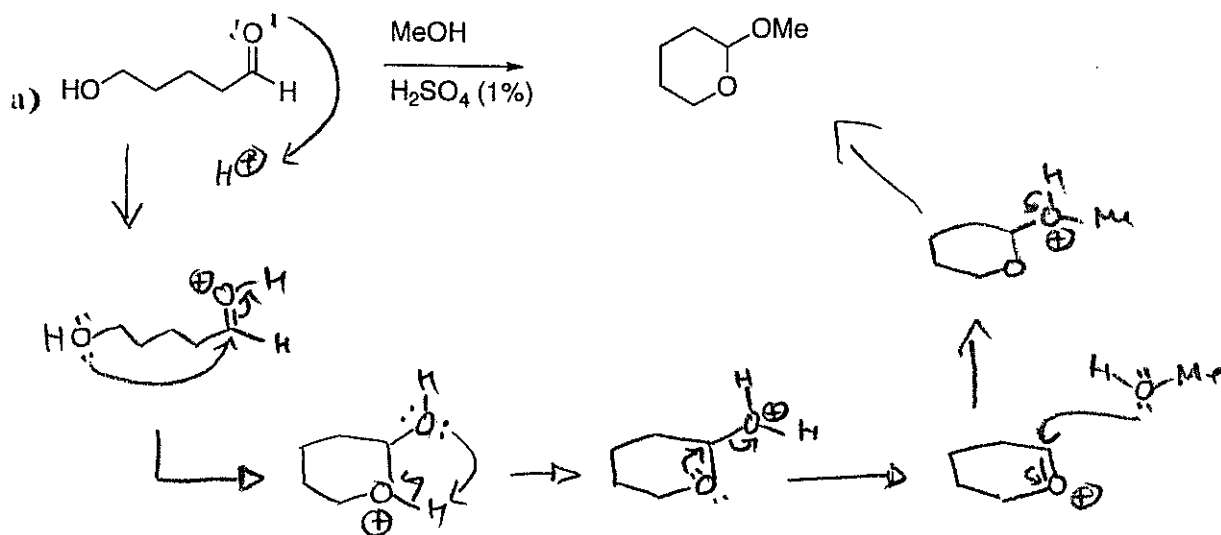
$\text{H}_2\text{O} / \text{H}_2\text{SO}_4$
(100%)
3 R M S



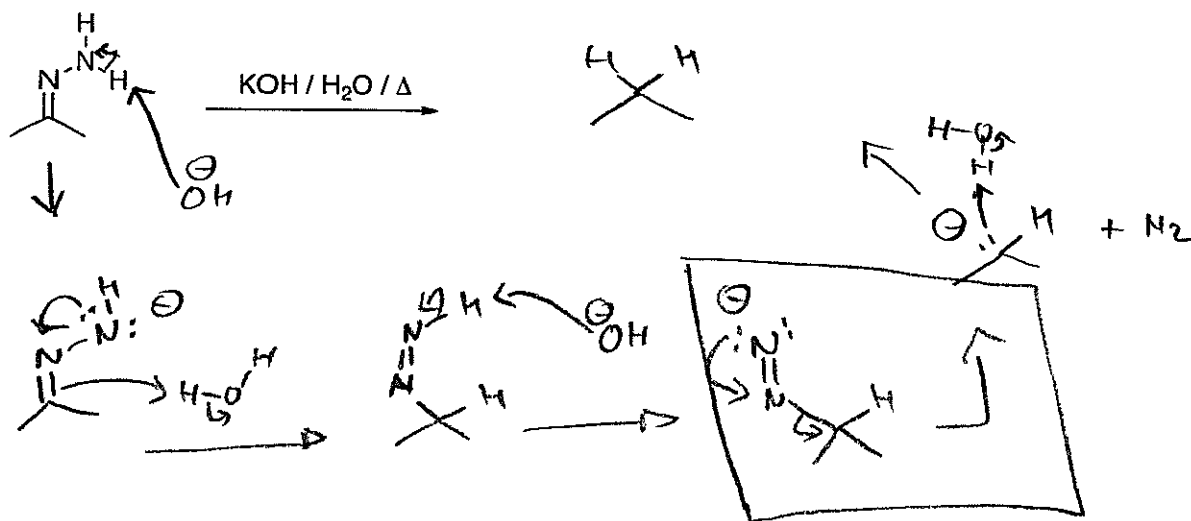
NaBH_4



3) Provide the mechanism for the following reaction. Show every intermediate with the proper charges and all the arrows required for each step of the reaction (12 pts)



b) Provide the product and mechanism for the reaction shown below. Show every intermediate with the proper charges and all the arrows required for each step of the reaction (3 pts for product 10 pts for mechanism)



One of the steps in the above mechanism violates one of the rules for writing mechanisms. Circle this step in your mechanism (2 pts).

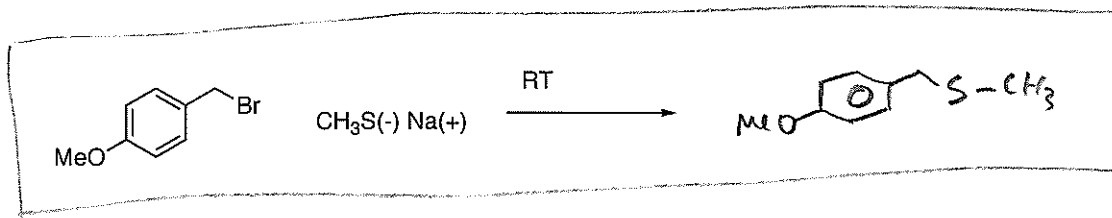
4a) In an electrophilic aromatic substitution reaction, can an **activating** group be a meta director (**yes** or **no**)? If so, give an example of such a group attached to a benzene ring, if not, just write "no".

No

b) In an electrophilic aromatic substitution reaction, can a **deactivating** group be an ortho-para director (**yes** or **no**)? If so, give an example of such a group attached to a benzene ring, if not, just write "no". (6 pts total for a and b)

YES -  or any halogen

5) Provide the products of the two reactions shown below (2 pts), **and circle the one that will proceed faster**. If more than one product can be formed, draw both (you don't have to indicate if they would be equal or if one would be major). Note that RT means room temperature (2 pts).



6) Provide the products of the two reactions shown below (4 pts), **and circle the one that will proceed faster**. If more than one product can be formed, draw both (you don't have to indicate if they would be equal or if one would be major). Note that Δ means heat. Hint: These are S_N1 reactions. (2 pts).

