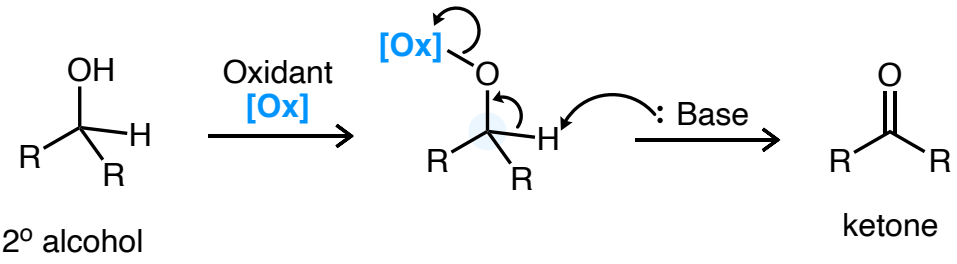
Reduction and Oxidation

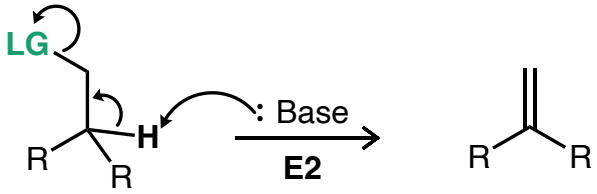
1. The generic mechanism for the oxidation of an alcohol is shown below. It is helpful to notice that it is similar to a mechanism you learned in organic chemistry 1 (S_N1, S_N2, E1, or E2).



A. **Identify the most similar reaction** (**S_N1, S_N2, E1, or E2**) to the alcohol oxidation mechanism.

The flow of electrons in the oxidation of an alcohol most closely resembles the **E2** mechanism.

B. **Draw a generic mechanism** for the reaction you selected.

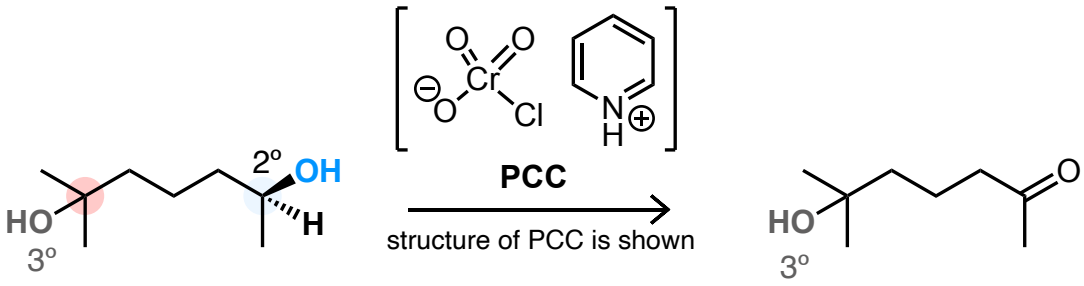


C. **Describe the similarities** between the oxidation mechanism and the reaction mechanism from part B.

Both reactions use a base to deprotonate a C—H bond and form a **π** bond in one step.

2. Draw the **single major product** of each reaction below. Describe in your own words why the reaction only takes place at one position/site within the starting material.

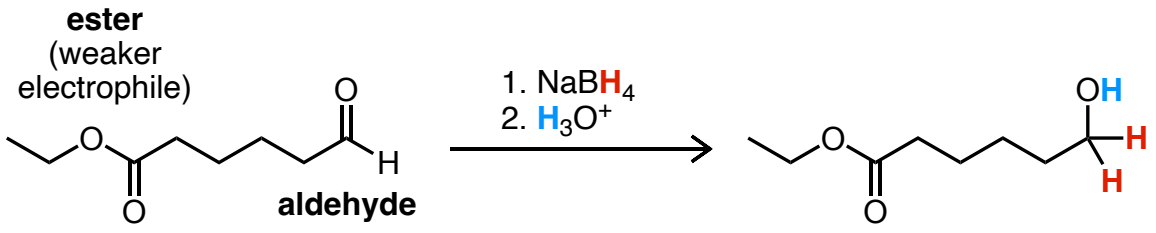
A.



Tertiary alcohols cannot be further oxidized. The mechanism for oxidation reaction requires at least one proton on the carbon bearing the OH group (highlighted above).

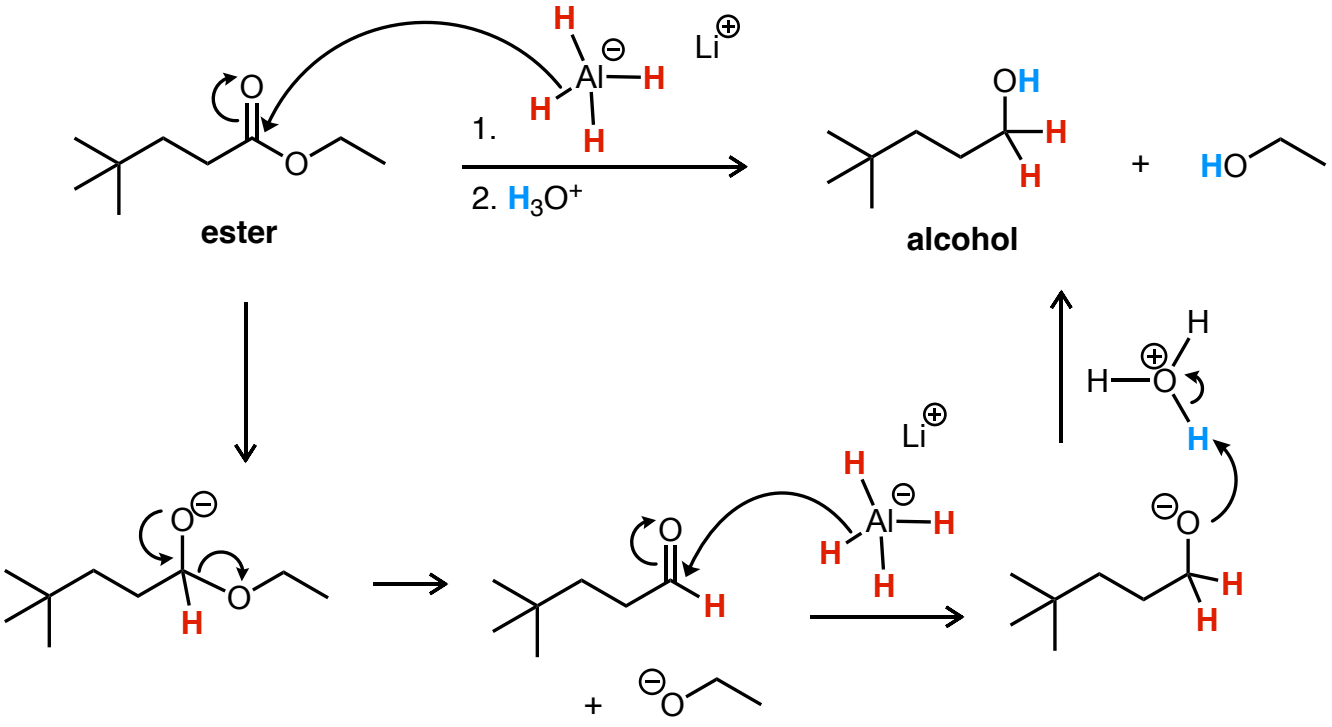
2. Draw the **single major product** of each reaction below. Describe in your own words why the reaction only takes place at one position/site within the starting material.

B.

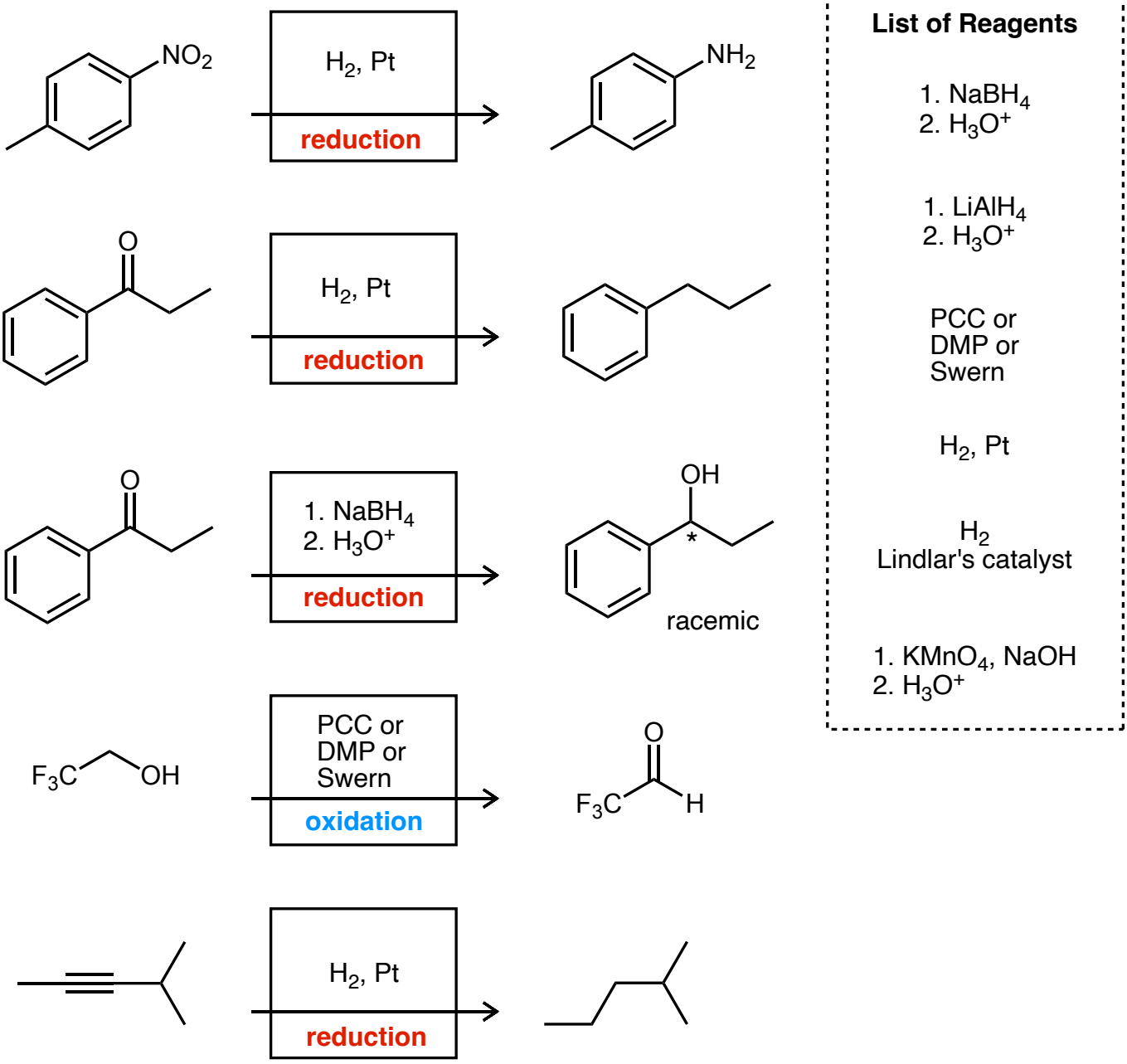


Sodium borohydride is not strong/reactive enough to reduce esters. Lithium aluminum hydride is a stronger/more reactive reducting agent that can enable the reduction of both aldehydes and esters.

3. Draw the **curved-arrow mechanism** for the **full reduction of an ester to an alcohol** using excess $LiAlH_4$.

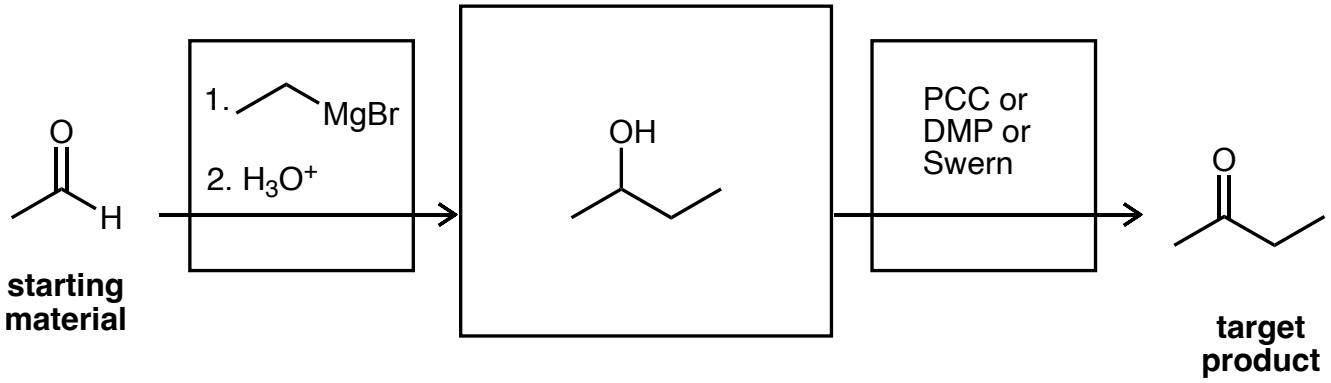


4. **Select the correct reagent** that would promote each reaction shown. Then, **define** it is either a **reduction** or an **oxidation**.

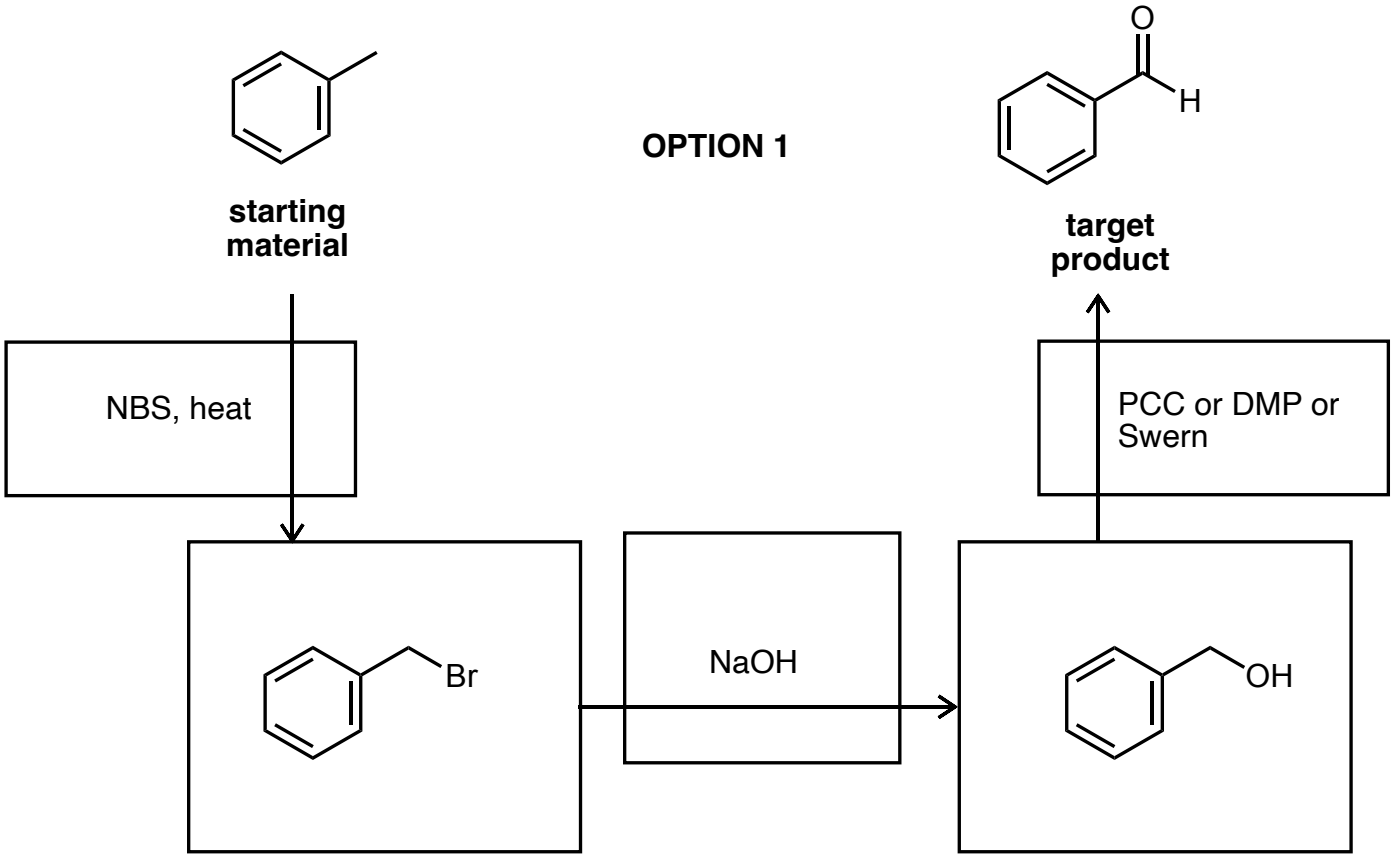


5. **Provide the missing reagents and intermediate products** needed to complete the multi-step synthesis below.

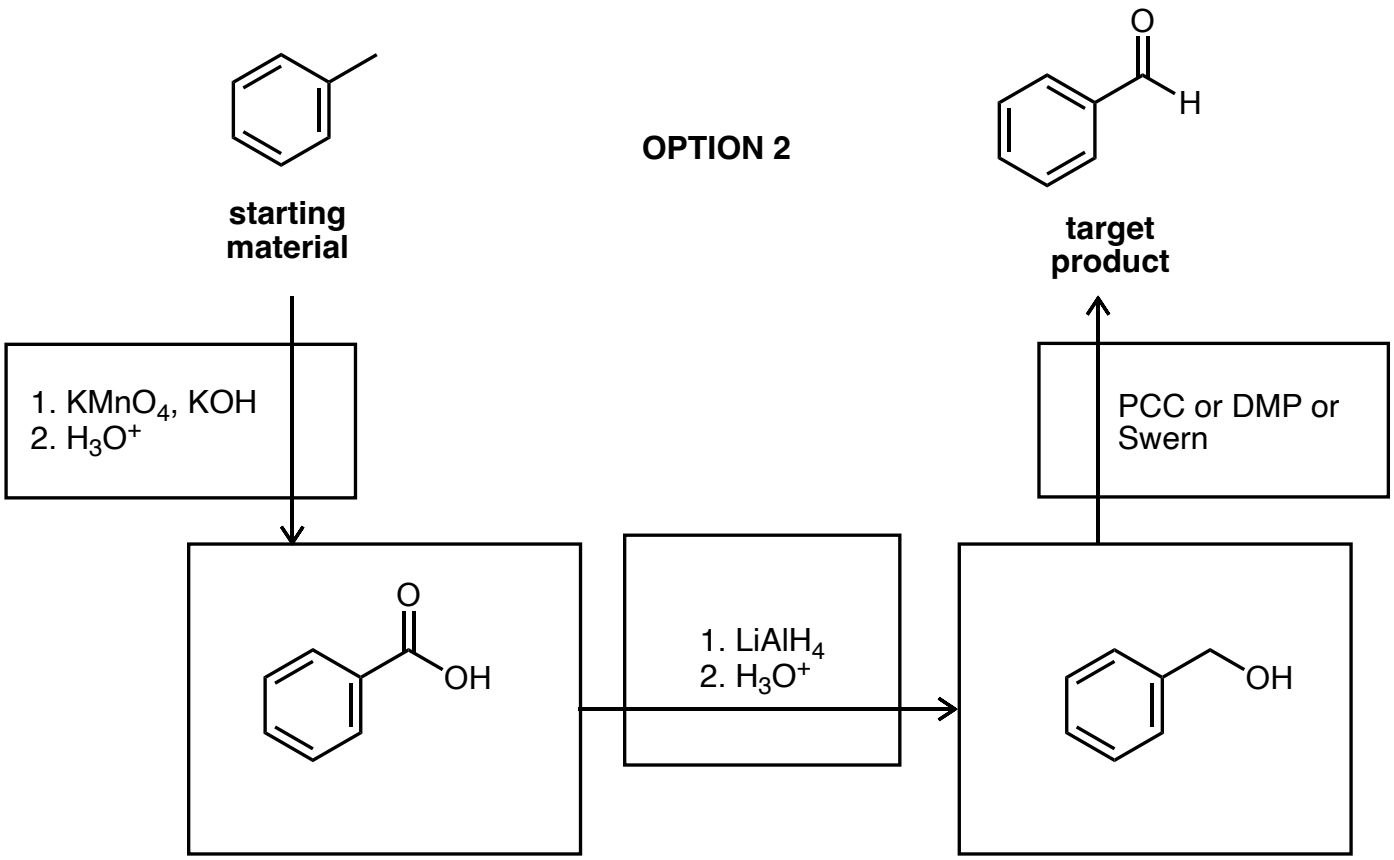
Note: You will need to use other reactions you know in combination with the reduction and oxidation reactions to solve these syntheses.



OPTION 1



OPTION 2


starting material
target product
1. $KMnO_4$, KOH
2. H_3O^+
PCC or DMP or Swern
1. $LiAlH_4$
2. H_3O^+
O
OH
O
H
OH