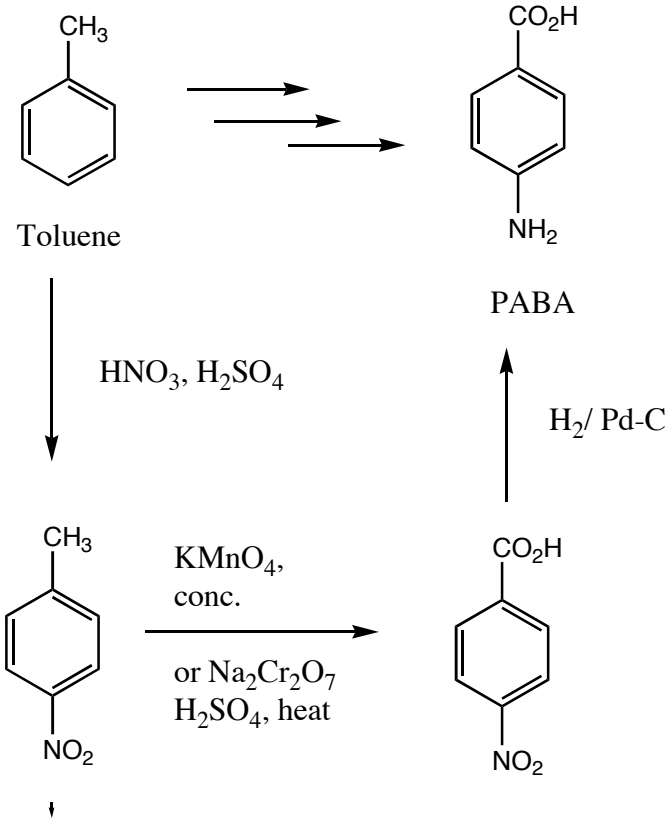
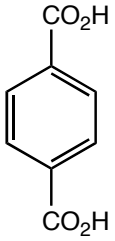
1. Propose a synthesis of PABA (para aminobenzoic acid) from toluene:

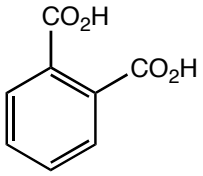


2. Account for the fact that phthalic acid has a *second* pKa (pKa_2) that is 5.4, whereas terephthalic acid has pKa_2=4.8:

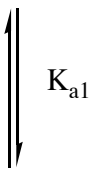
Terephthalic Acid Phthalic Acid

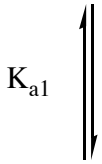
pKa_2=4.8



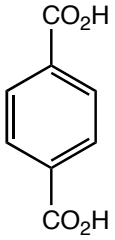


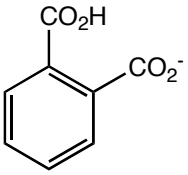
pKa_2=5.4

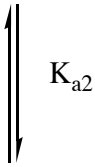


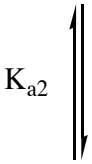


consider the stability of their conjugate bases

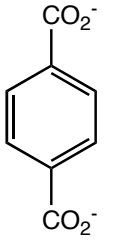


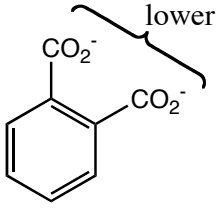






negative charges very close to each other=> less stable, leading to lower observed acidity

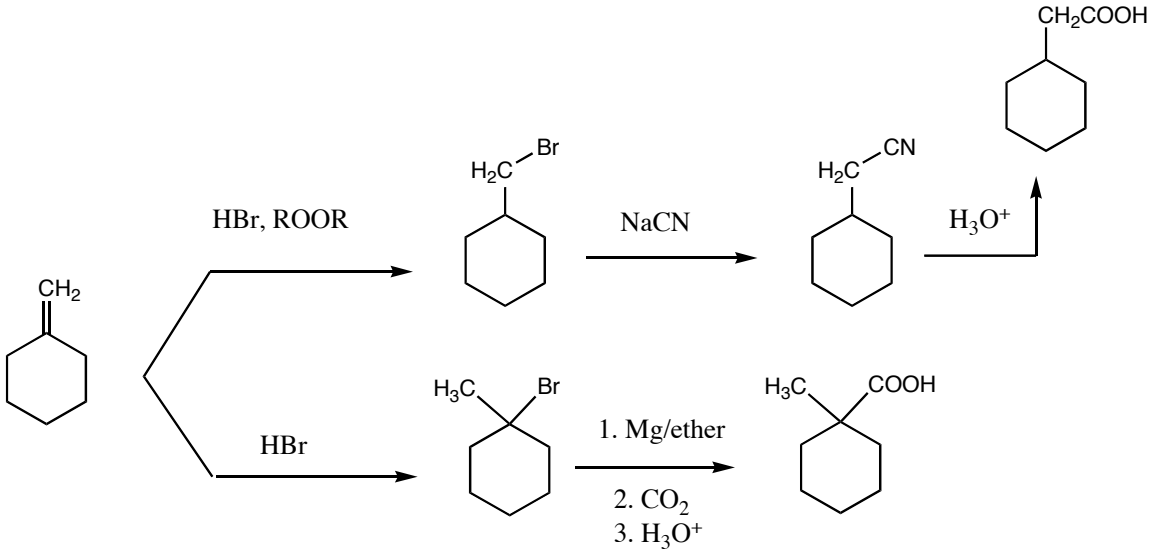




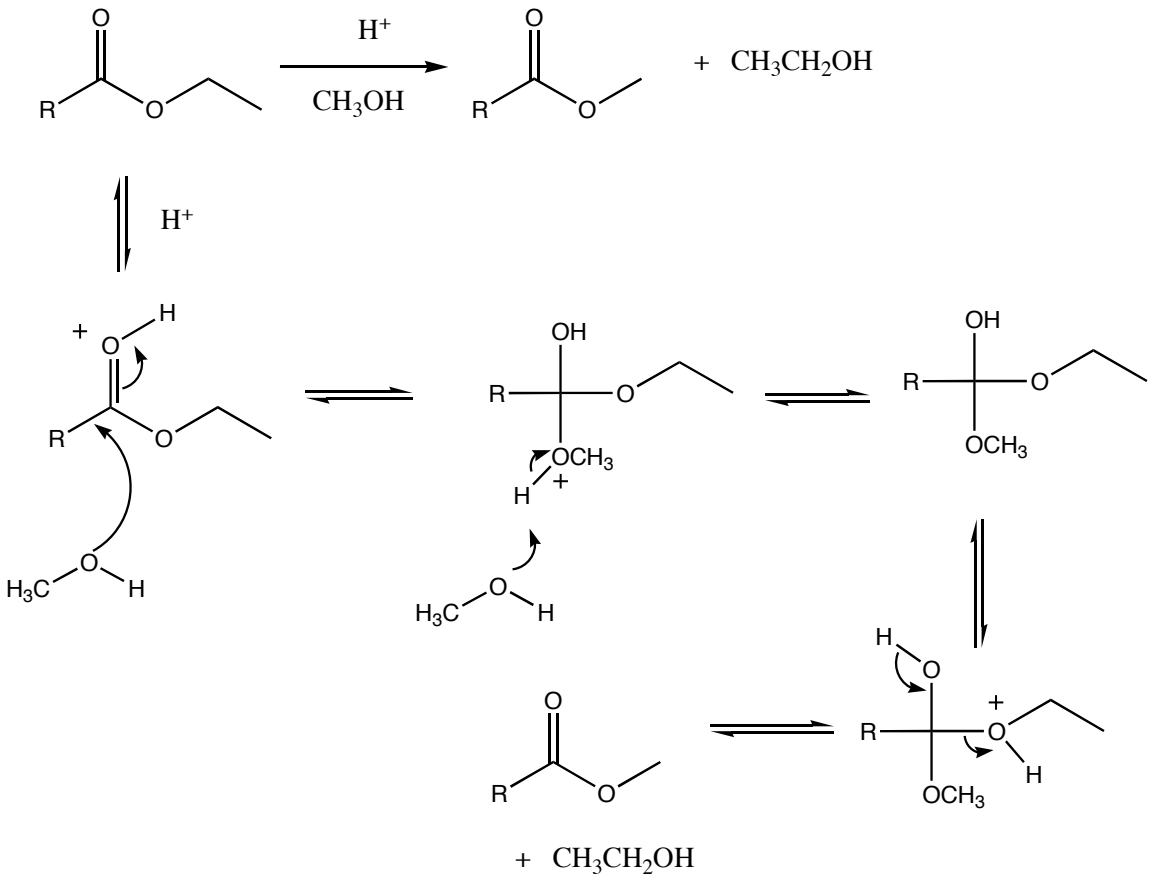
strong electrostatic repulsion

negative charges far from each other: more stable leads to increased observed acidity

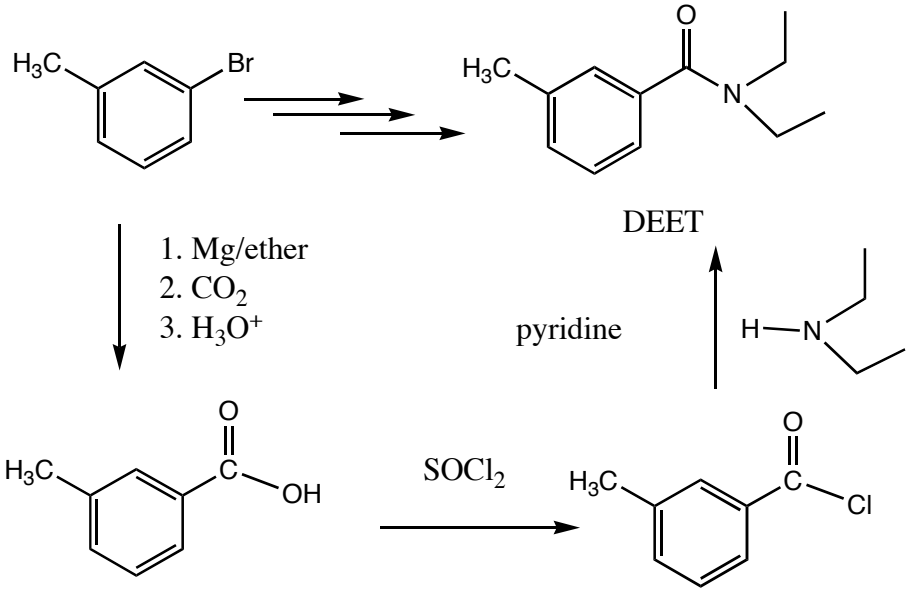
3. How would you carry out the following transformations?



4. Account for the fact that treatment of an ethyl ester with an acid catalyst in methanol solution yields the methyl ester product:

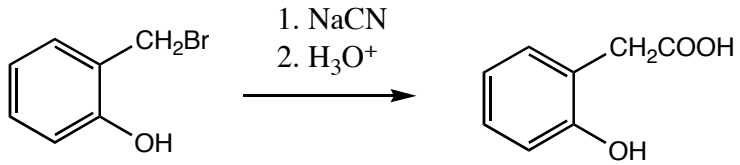


5. DEET (N,N-Diethyl-m-toluamide) is the active ingredient in many insect-repellent sprays. How might you synthesize this substance from m-bromotoluene.

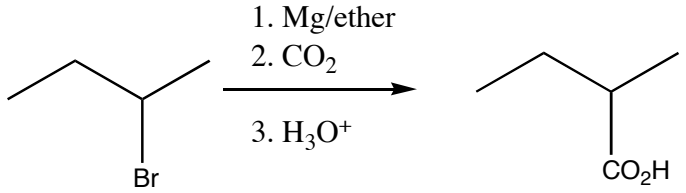


6. Indicate appropriate methods for the following acid syntheses:

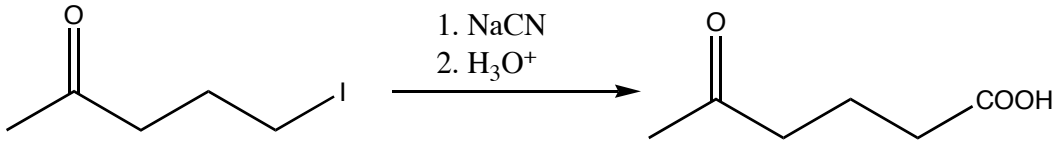
(a)



(b)



(c)



(d)