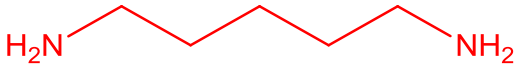
Problem Set 10 – Reactions of amines

1. Putrescine and cadaverine are found in rotting flesh. Putrescine ($C_4H_{12}N_2$) may be synthesized by treating 1,2-dibromoethane with KCN followed by hydrogenation. Treatment of 1,5-dibromopentane with ammonia gives cadavrine ($C_5H_{14}N_2$).

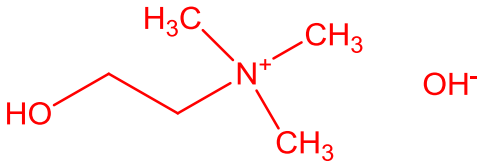
    a. What is the structure of putrescine?

    b. What is the structure of cadavrine?

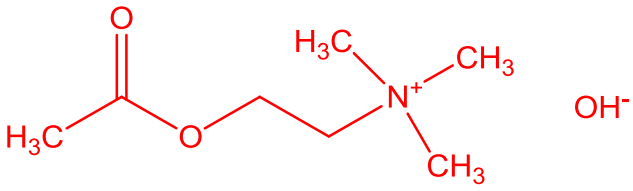


2. Choline, $C_5H_{15}O_2N$, is a constituent of phospholipids. It dissolves in water to give a basic solution. It can be prepared by reaction of ethylene oxide with trimethylamine in the presence of water. Acetylcholine, $C_7H_{17}O_3N$, is its acetyl derivative.

    a. What is the structure of choline?

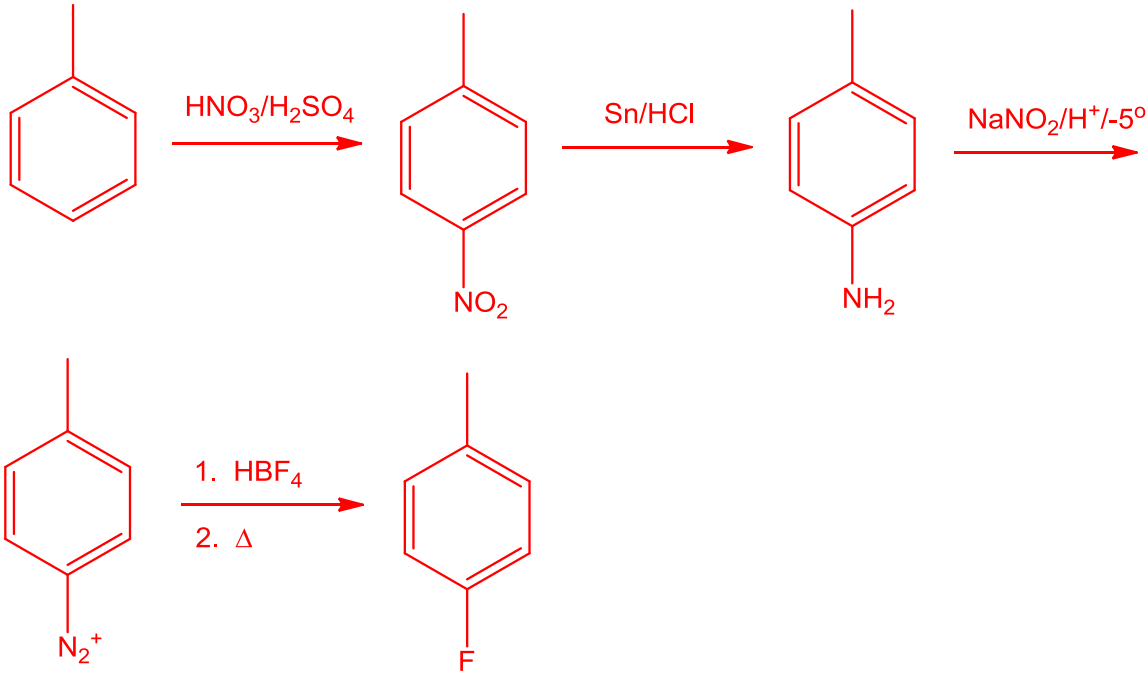


    b. What is the structure of acetylcholine?

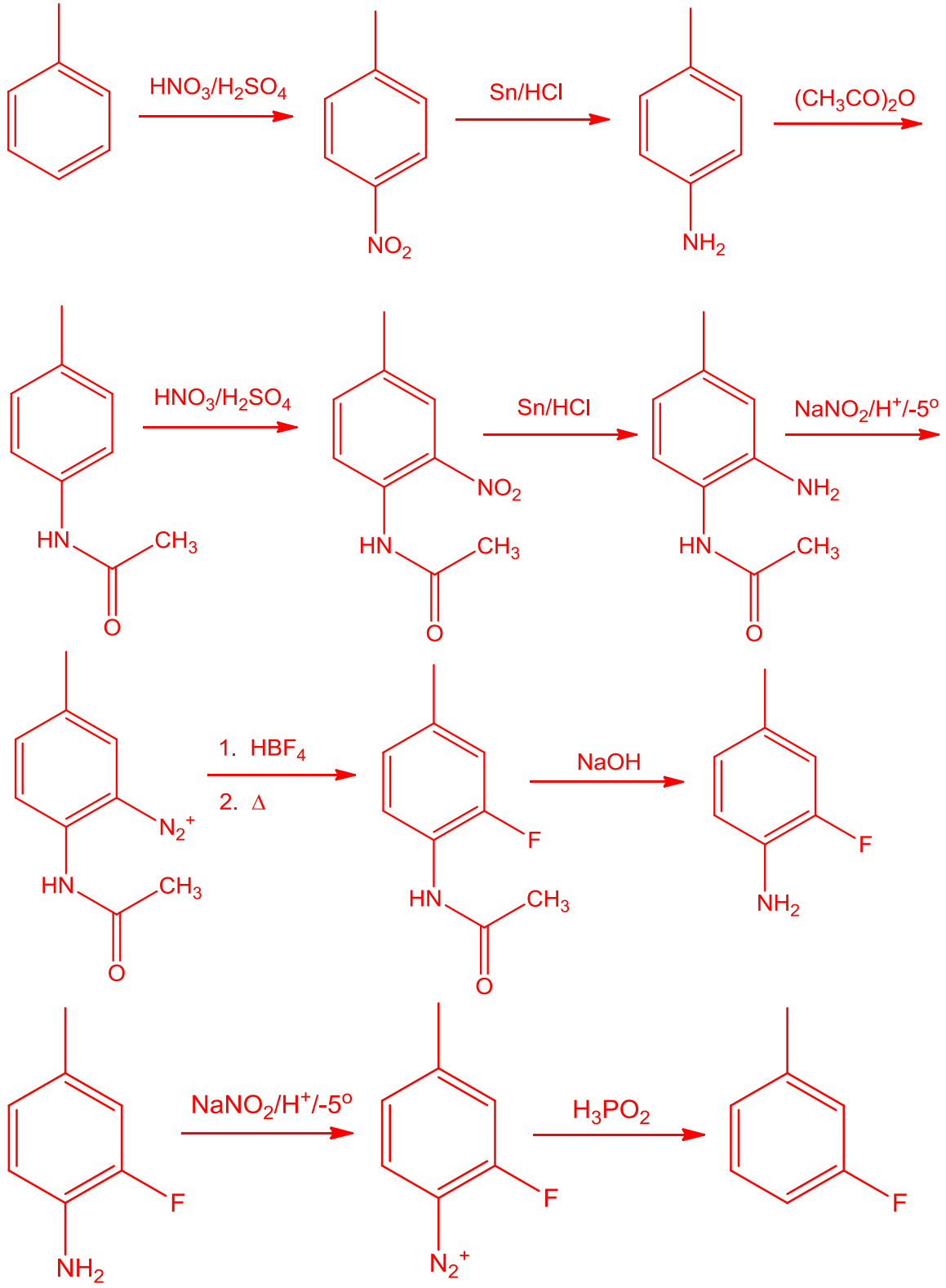


3. Write equations for each step in the following syntheses:

    a. toluene $\rightarrow$ *p*-fluorotoluene

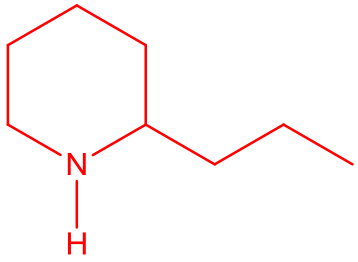


b. toluene $\rightarrow$ *m*-fluorotoluene

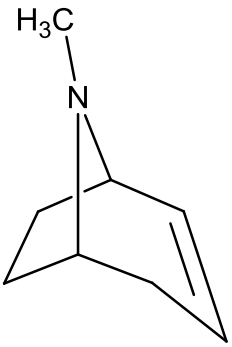


4. Coniine, $C_8H_{17}N$, is the toxic ingredient of poison hemlock, drunk by Socrates. When subject to exhaustive methylation and Hofmann elimination, coniine

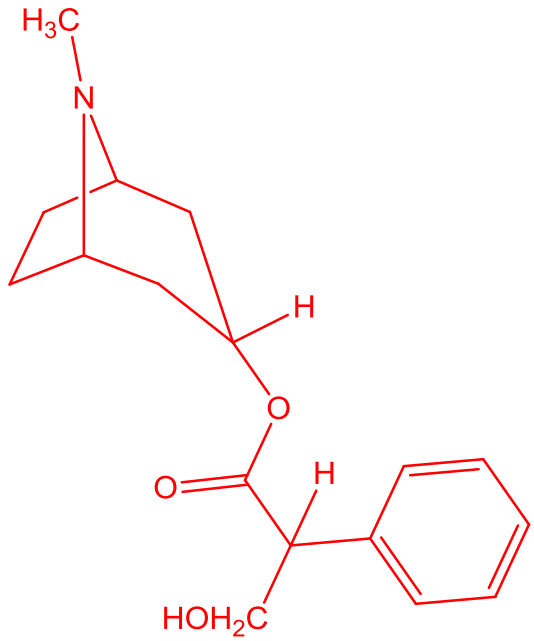
gives 5-(*N*,*N*-dimethylamino)-1-octene. If coniine is a secondary amine, what is its structure?

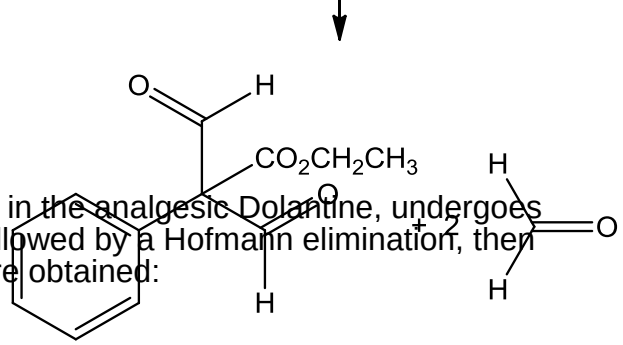


5. Atropine, $C_{17}H_{23}NO_3$, is a poisonous alkaloid isolated from *Atropa belladonna*, deadly nightshade. Base hydrolysis gives tropic acid, $C_6H_5CH(CH_2OH)CO_2H$, and tropine, $C_8H_{15}NO$. Tropine, an optically inactive alcohol reacts with H_2SO_4 to give tropidene:



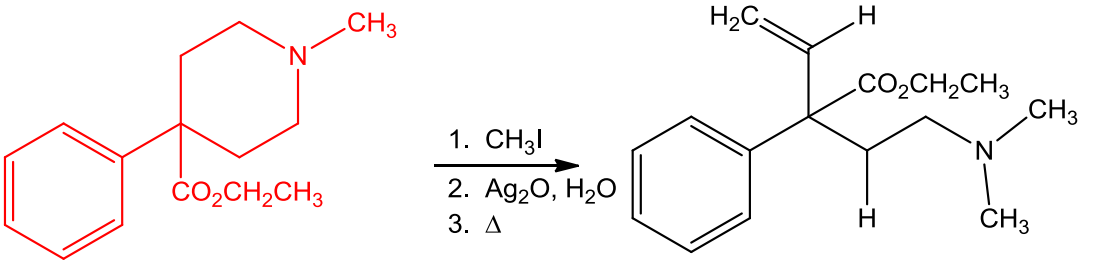
What is the structure of atropine?



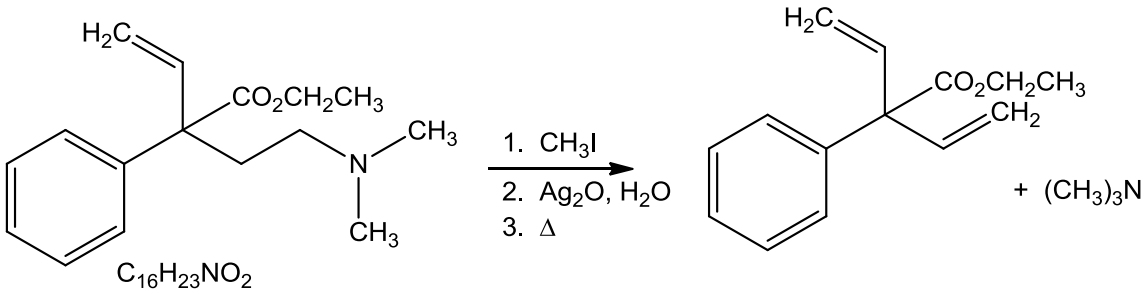


6. When pethidine, the active ingredient in the analgesic Dolantine, undergoes two exhaustive methylations, each followed by a Hofmann elimination, then an ozonolysis, the following results are obtained:

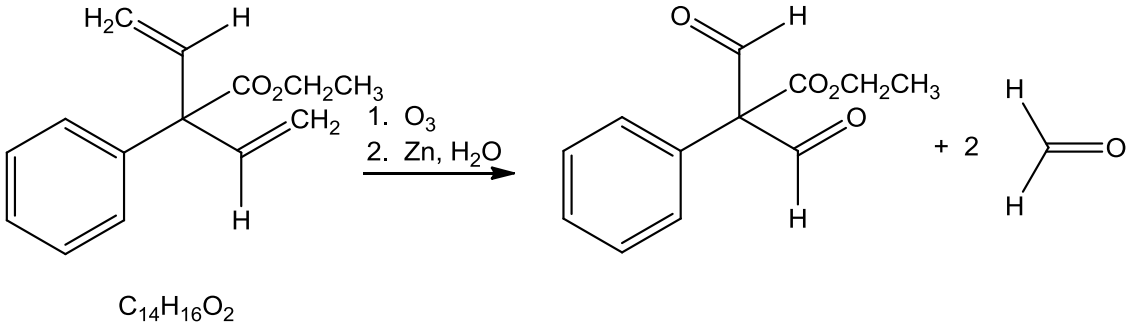
Propose a structure for pethidine.



péthidine



$C_{16}H_{23}NO_2$



$C_{14}H_{16}O_2$