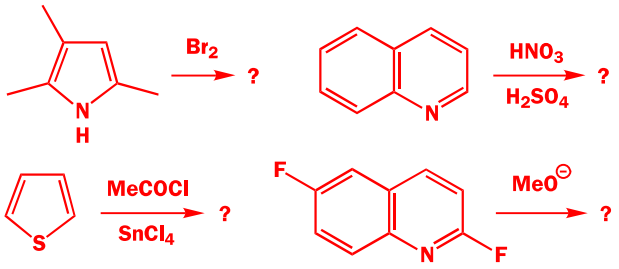
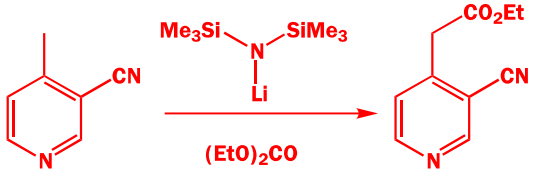
Problems

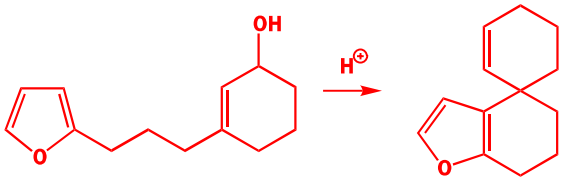
1. For each of the following reactions: (a) state what kind of substitution it suggests; (b) suggest what product might be formed if monosubstitution occurs.



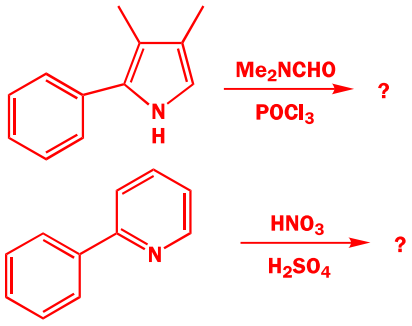
2. Give a mechanism for this side-chain extension of a pyridine.



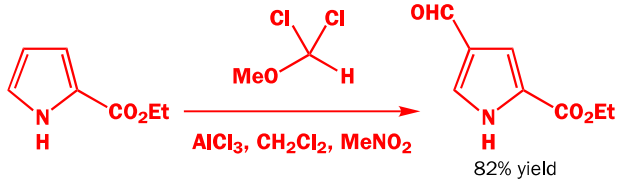
3. Give a mechanism for this reaction, commenting on the position on the furan ring that reacts.



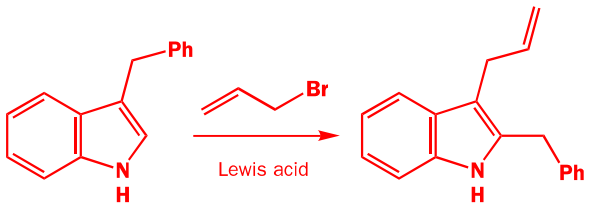
4. Suggest which product might be formed in each of these reactions and justify your choices.



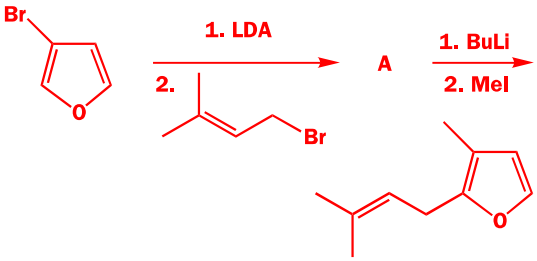
5. Comment on the mechanism and selectivity of this reaction of a pyrrole.



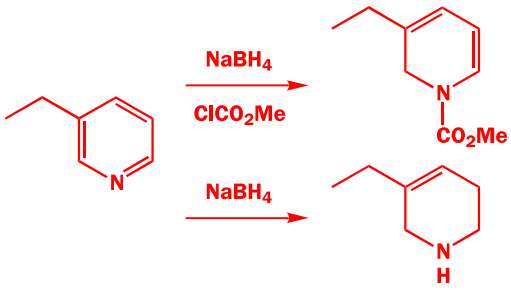
6. Explain the formation of the product in this Friedel–Crafts alkylation of an indole.



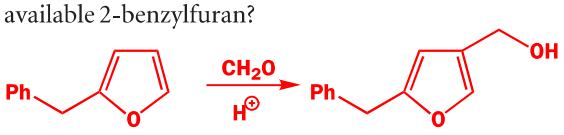
7. Explain the order of events and choice of bases in this sequence.



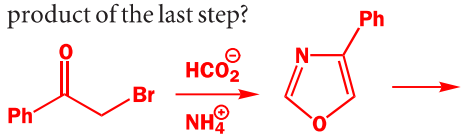
8. Explain the difference between these two pyridine reductions.

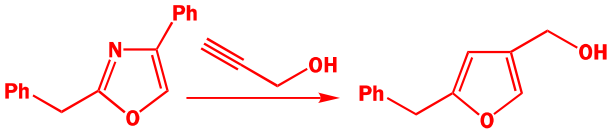


9. Why can this furan not be made by the direct route from available 2-benzylfuran?

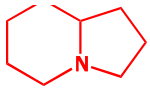


The same furan can be made by the route described below. Suggest mechanisms for the first and the last step. What is the other product of the last step?

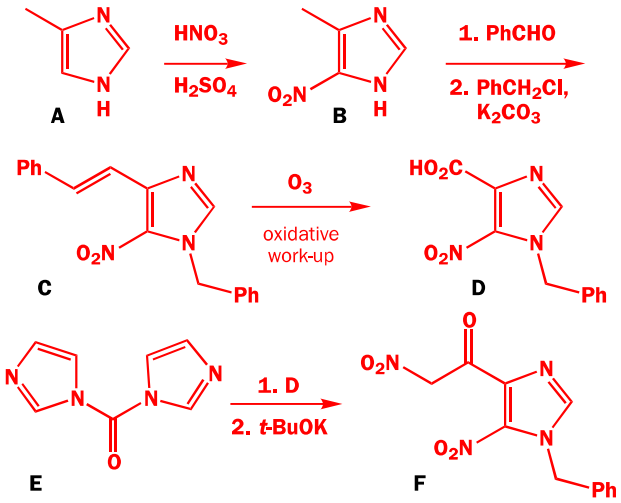




10. What aromatic system might be based on the skeleton given below? What sort of reactivity might it display?

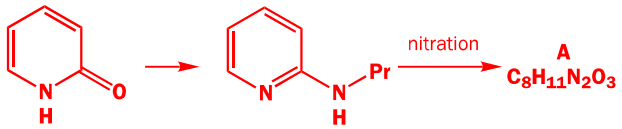


11. The reactions outlined in the chart below describe the early steps in a synthesis of an antiviral drug by the Parke–Davis company.



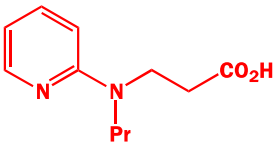
Consider how the reactivity of imidazoles is illustrated in these reactions, which involve not only the skeleton of the molecule but also the reagent E. You will need to draw mechanisms for the reactions and explain how they are influenced by the heterocycles.

12. Suggest how 2-pyridone might be converted into the amine shown. This amine undergoes mononitration to give compound A with the NMR spectrum given. What is the structure of A? Why is this isomer formed?

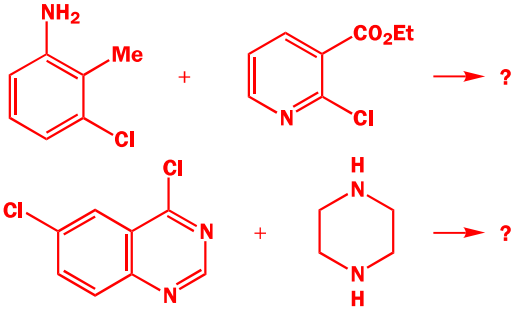


δ_H 1.0 p.p.m. (3H, t, *J* 7 Hz), 1.7 p.p.m. (2H, sextet, *J* 7 Hz), 3.3 p.p.m. (2H, q, *J* 7 Hz), 5.9 p.p.m. (1H, broad s), 6.4 p.p.m. (1H, d, *J* 8 Hz), 8.1 p.p.m. (1H, d, *J* 2 Hz), and 8.9 p.p.m. (1H, d, *J* 2 Hz).

Compound A was needed for conversion into the potential enzyme inhibitor below. How might this be achieved?



13. Suggest what the products of these nucleophilic substitutions might be.



14. The synthesis of DMAP, the useful acylation catalyst mentioned in Chapters 8 and 12, is carried out by initial attack of thionyl chloride ($SOCl_2$) on pyridine. Suggest how the reactions might proceed.