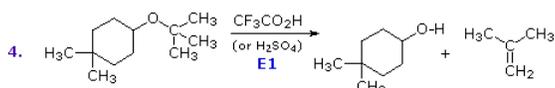
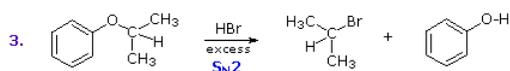
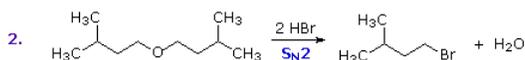
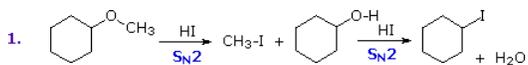


## 9.5: Reaction of Ethers with Strong Acid

The most common reaction of ethers is cleavage of the C–O bond by strong acids. This may occur by  $S_N1$  or E1 mechanisms for 3°-alkyl groups or by an  $S_N2$  mechanism for 1°-alkyl groups. Some examples are shown in the following diagram. The conjugate acid of the ether is an intermediate in all these reactions, just as conjugate acids were intermediates in certain alcohol reactions.



The first two reactions proceed by a sequence of  $S_N2$  steps in which the iodide or bromide anion displaces an alcohol in the first step, and then converts the conjugate acid of that alcohol to an alkyl halide in the second. Since  $S_N2$  reactions are favored at least hindered sites, the methyl group in example #1 is cleaved first. The 2°-alkyl group in example #3 is probably cleaved by an  $S_N2$  mechanism, but the  $S_N1$  alternative cannot be ruled out. The phenol formed in this reaction does not react further, since  $S_N2$ ,  $S_N1$  and E1 reactions do not take place on aromatic rings. The last example shows the cleavage of a 3°-alkyl group by a strong acid. Acids having poorly nucleophilic conjugate bases are often chosen for this purpose so that E1 products are favored. The reaction shown here (#4) is the reverse of the tert-butyl ether preparation described earlier.

### Contributors

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