Answers to Problem 64, Chemistry 301X - 2006

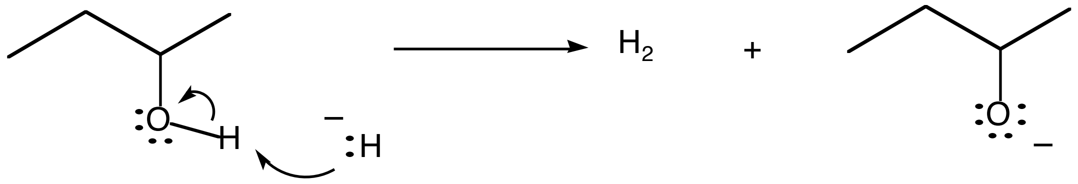
To make (a), we need to do an S_N2 displacement (note the inversion). So we need a good nucleophile (HS^-), a nonpolar solvent to minimize S_N1, and a good leaving group like OTs.

To make (b), we need to do an S_N1. A good leaving group is still necessary, but we want a poor nucleophile such as H_2O, and a polar solvent to aid ionization.

To make (c), the product of a Saytzeff E2 elimination, we want a good base (not nucleophile), and we might as well use a big one to minimize S_N2; hence $(CH_3)_3C\,O^-$. We still need a good leaving group (OTs is fine) and a nonpolar solvent to minimize S_N1.

For (d), we need to do a Hofmann elimination, so the conditions of (c) will do as long as we use a Hofmann leaving group such as F.

When L = OH, there can be no displacement or elimination. Hydride is a poor nucleophile and a poor initiator of elimination reactions. But it is a great Brønsted base when it comes to deprotonations. So the reaction is the formation of the alkoxide by deprotonation of the alcohol. As H_2 is the other product, the reaction is irreversible.



In the first S_N2 - the more polar solvent makes the reaction go faster- it will stabilize the polar TS more than the nonpolar starting materials.

In the second S_N2, the more polar solvent makes the reaction go slower. The more polar the solvent, the more that starting materials will be stabilized relative to the less polar TS.

See Book, pp 298-299 for diagrams.