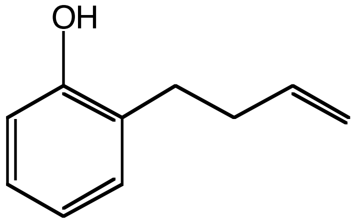
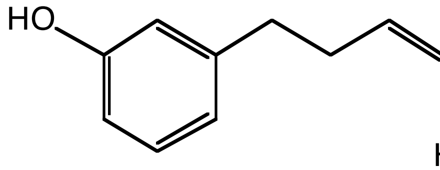
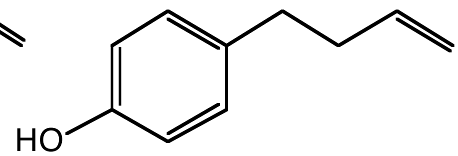
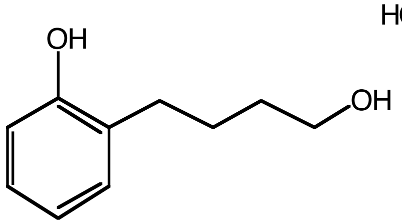
Answers to Problem 94, Chemistry 301X - 2006

The three possibilities for **1** are:

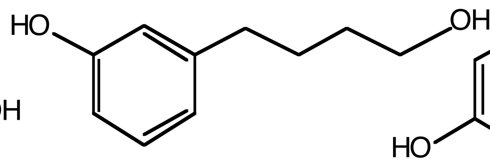




Reaction one is a hydroboration/oxidation. The product is an alcohol, and there are no surprises here at all. There are still three possibilities, **X**, **Y**, and **Z**:

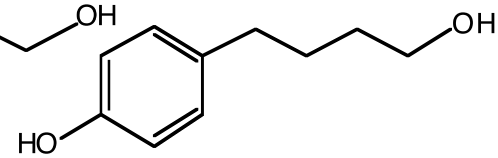
1



(**X**)



(**Y**)



(**Z**)

Reaction two makes a tosylate out of an alcohol - still three possibilities, **W**, **U**, and **V**

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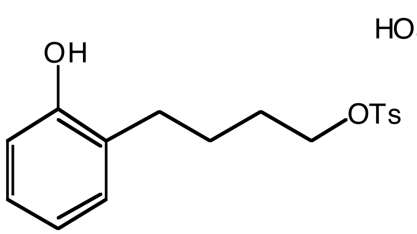
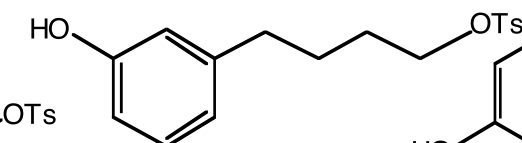
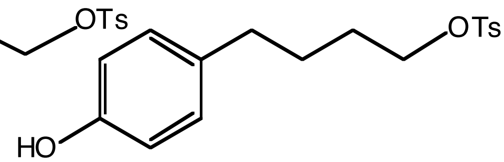


(**W**)



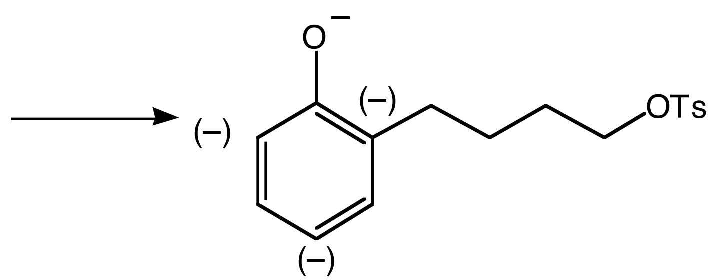
(**U**)



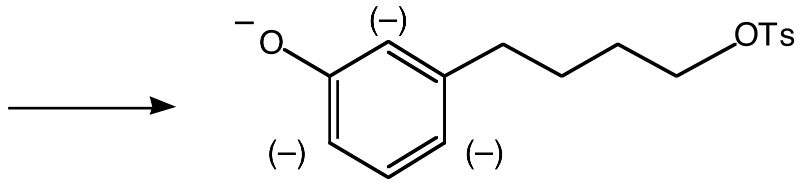
(**V**)

The third reaction does the trick. Look at the formula- the tosylate is lost. That is hardly surprising, as that is tosylate's job - to be a leaving group. But this is no ordinary S_N2 displacement or E2 elimination. Both of these reactions would leave an OH in the molecule and the IR specifically tells you there is no OH left. Something must happen that destroys the OH (some of the "action" must be at the OH on the ring). The strong band at 1670 cm^{-1} is indicative of a conjugated carbonyl group, and the ^{13}C NMR tells you that there are only six different carbons in **2**. There has been a fair amount of symmetrization. What can happen in base, if there is no displacement or elimination? Well, if the OH has to go away, let's start there - how about a deprotonation by carbonate? The result is a well resonance stabilized intermediate in each case. For **V**, some resonance forms are drawn out, for others the forms are indicated with "(—)".

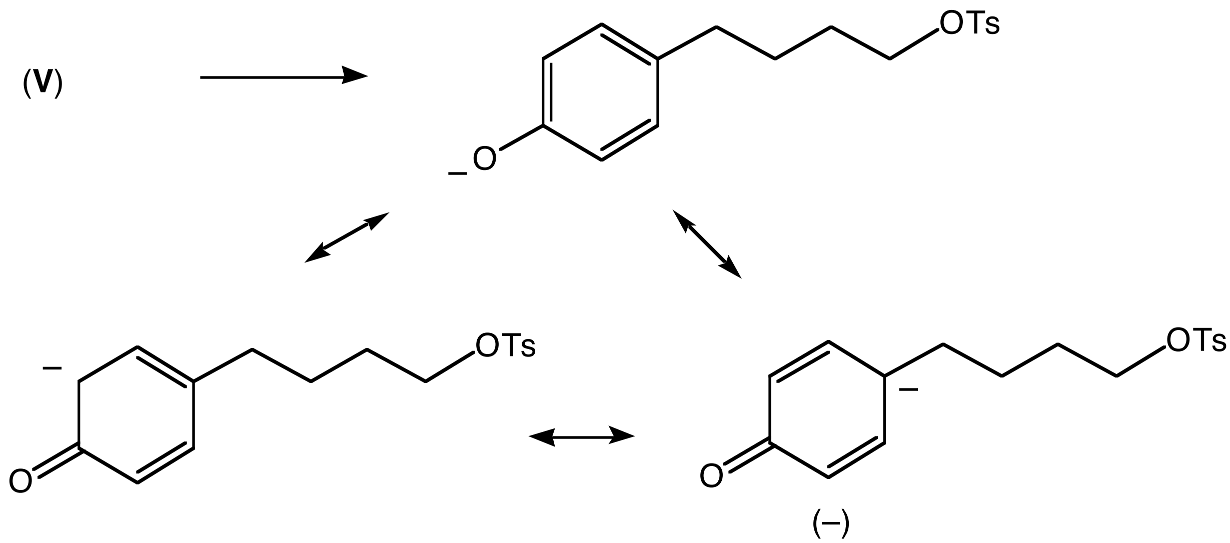
(**W**)



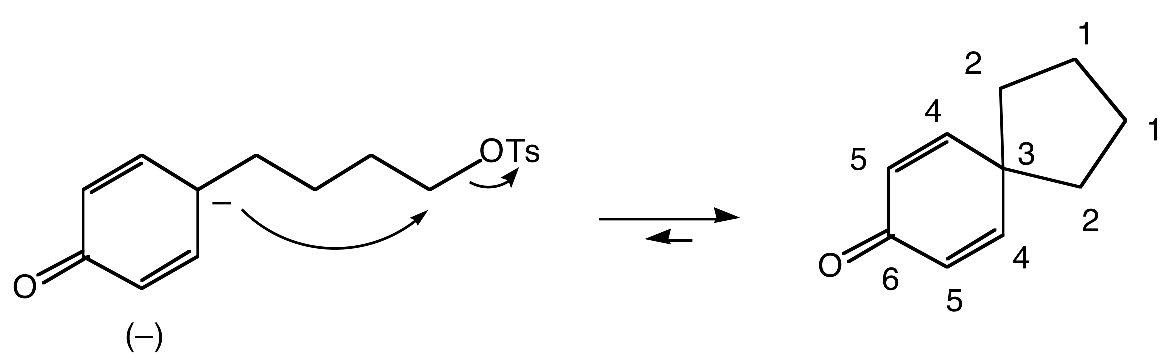
(**U**)



(**V**)



Now many intramolecular displacements of OTs are possible, but only the one shown yields a product with only six different carbons.



2

The structure of **1** must be: