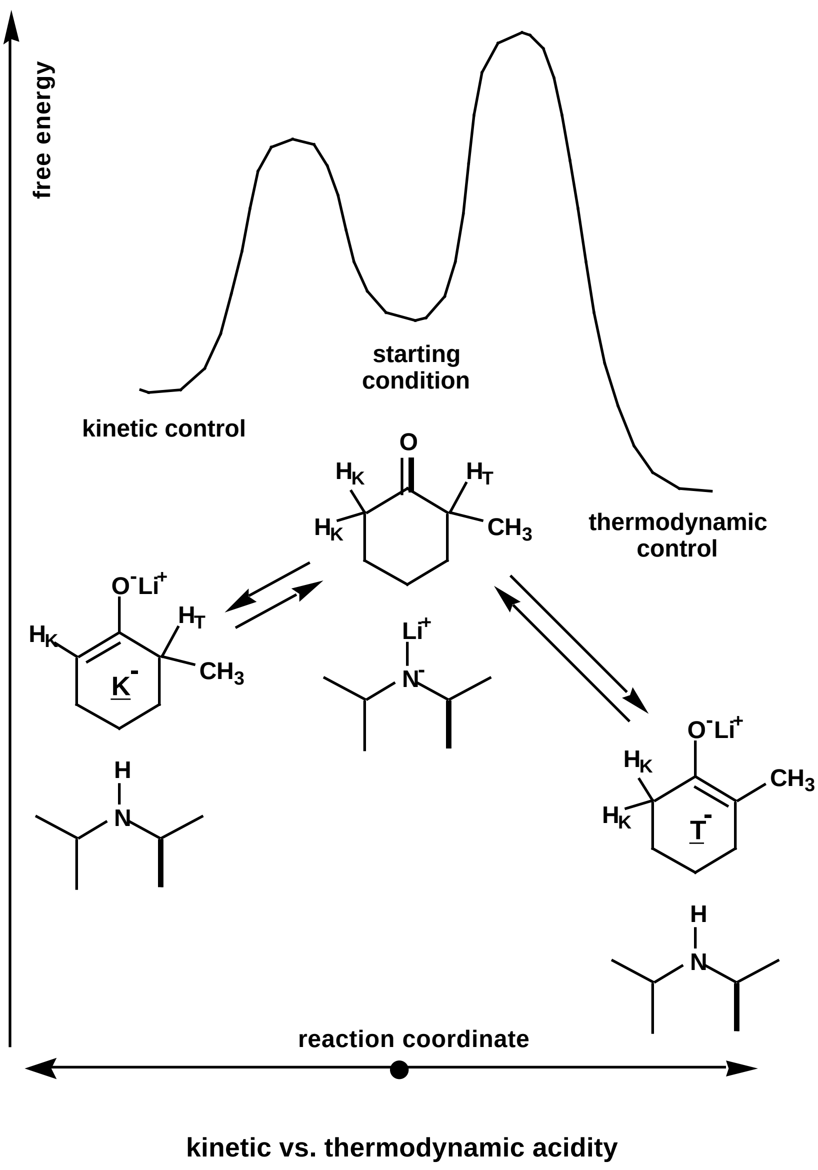
Text Related to Segment 11.05 ©2002 Claude E. Wintner

As we have defined the concepts of acidity and basicity so far, our discussion has focused only on *equilibrium* acidity and basicity. However, it should be emphasized that kinetic considerations may intervene. A proton that is thermodynamically more acidic than another may nevertheless, for kinetic reasons, *not* be on average the first one to be lost in a particular reaction with a base. In such a case we speak of *kinetic* acidity or basicity:



kinetic vs. thermodynamic acidity

For example (above), in the interaction between 2-methylcyclohexanone and the large, sterically hindered base lithium diisopropylamide, the base removes one of the less hindered hydrogen atoms H_K to form enolate anion K^- at a rate one hundred times greater than it removes the more hindered hydrogen atom H_T to form enolate anion T^-, even though at equilibrium T^- is the favored — more stable — enolate by a factor of ten. Thus, if the reaction is run for a relatively short time period and at a temperature at which T^- is formed slowly with respect to that period, then K^- is the observed product. However, if enough time is allowed to elapse so that equilibrium is established — or, alternatively, if the system is heated to a temperature high enough to increase the rates of all processes sufficiently so that equilibrium can be established within the original time frame — then T^- is the observed product. We have here a very nice example of the possibility of kinetic versus thermodynamic control of a chemical reaction.

In the analysis above we have sidestepped an extremely interesting question: *Which* of the two diastereotopic hydrogen atoms H_K in any individual — chiral — molecule of 2-methylcyclohexanone will be more rapidly removed? Indeed, for the particular enantiomer shown below, in the (favorable) conformation shown, the removal takes place most rapidly for the hydrogen atom (H_K1), as shown. That this should be the case will become clearer in the sequel.