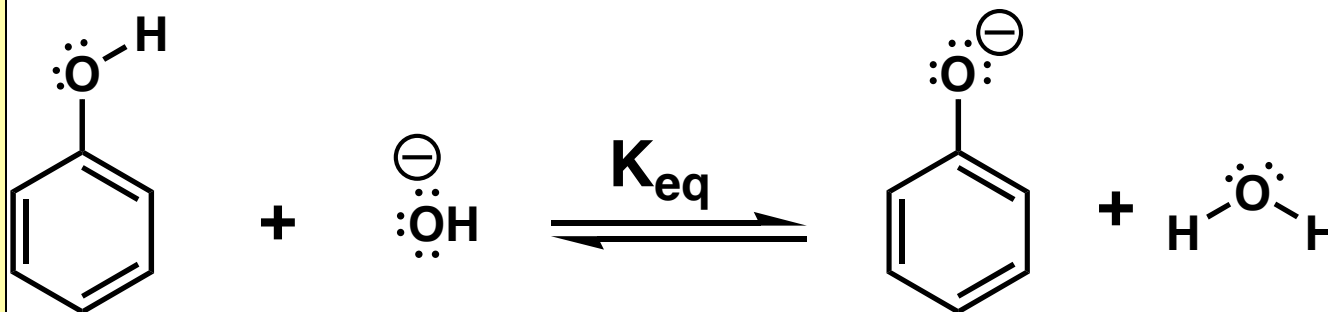


# The Reaction Coordinate Diagram for Proton Transfer

$K_{eq} > 1$  for this proton transfer step (soon we will be able to predict this result, but for now just accept the fact). Since  $K_{eq} > 1$ , the reaction is thermodynamically downhill; case 1 of Hammond's Postulate applies. The  $TS^\ddagger$  is early, and the  $TS^\ddagger$  structure more closely resembles the reactants.



The complete reaction coordinate diagram includes the structures of the reactants, products and a representation of the  $TS^\ddagger$ . The rate of the reaction in the forward direction is determined by  $\Delta G_f^\ddagger$  while the rate of the reaction in the backwards direction is determined by  $\Delta G_b^\ddagger$ . Based on the relative heights of  $\Delta G_f^\ddagger$  and  $\Delta G_b^\ddagger$ , notice that the forward rate is faster than the backward rate. Recall that  $K_{eq}$  is given by the ratio of the forward to backward rate coefficients. The driving force for the reaction is determined by  $\Delta G^\circ$ .

