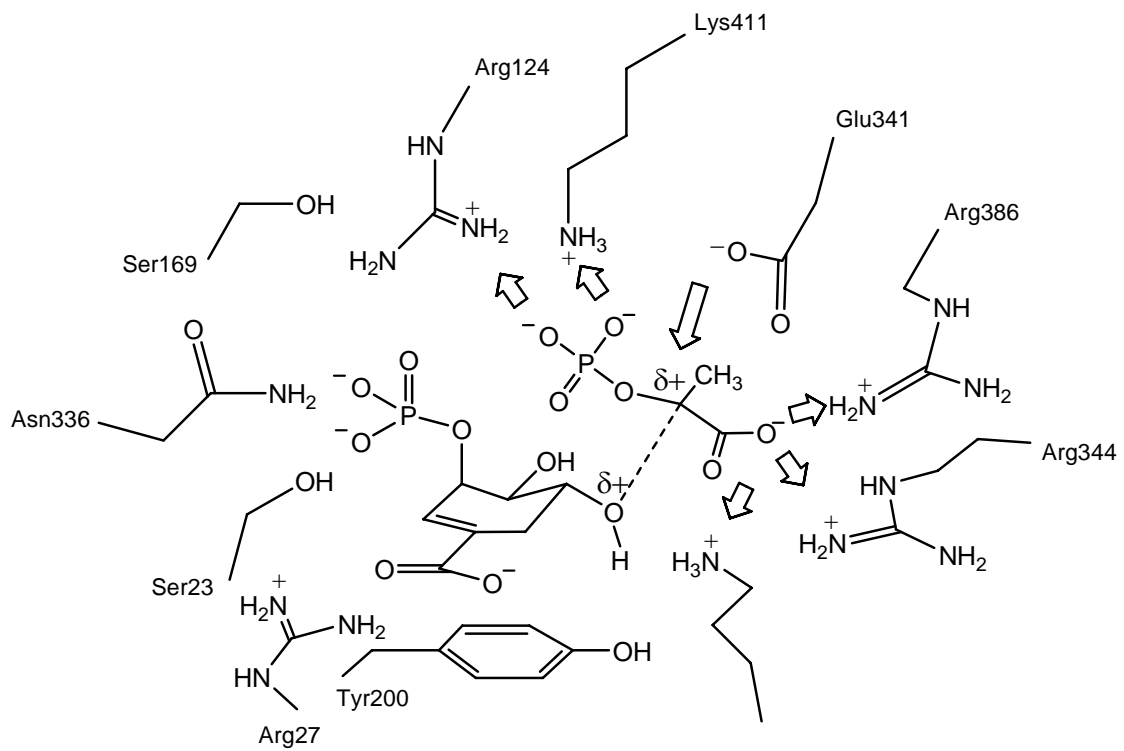


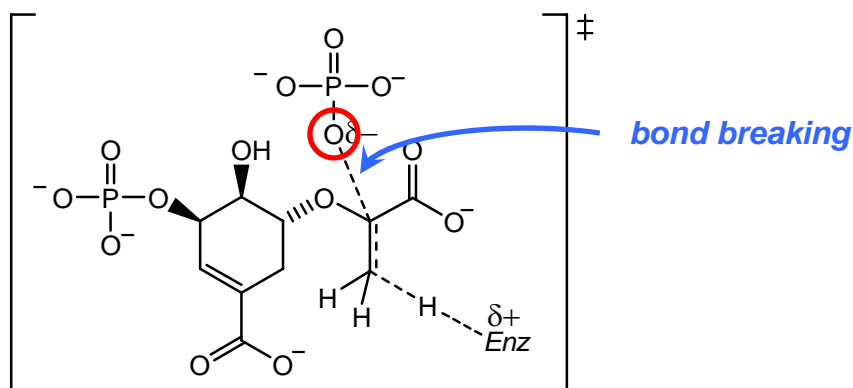
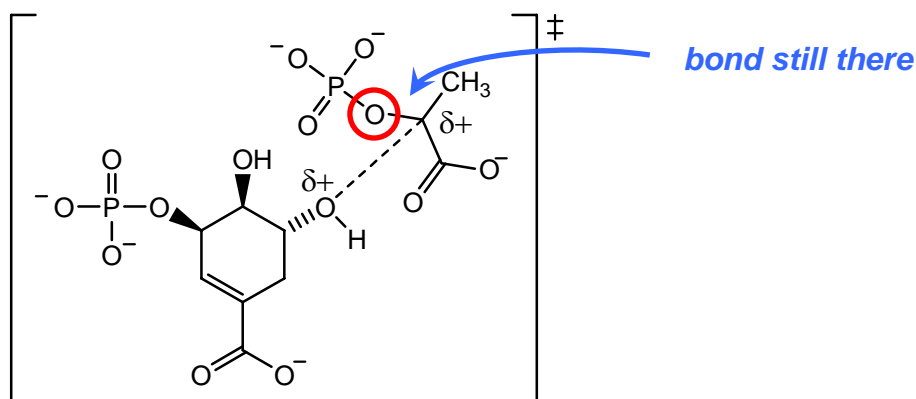
c)



I've drawn stabilizing electrostatic interactions as outline arrows. It's clear that the carboxylate and phosphate are stabilized by interactions with all of the positively charged residues, but I like to think that Glu341 plays a special stabilizing role towards the developed positive charge at the transition state. This charge is not present in EAB, and represents a special enthalpic stabilization of the transition state that is different from starting materials.

d) In the previous question, we decided that the enzyme acts on both  $\Delta H^\ddagger$  and  $\Delta S^\ddagger$ . So, I would expect  $\Delta H^\ddagger_{\text{cat}} < \Delta H^\ddagger_{\text{uncat}}$  and  $\Delta S^\ddagger_{\text{cat}} > \Delta S^\ddagger_{\text{uncat}}$ .

e) Any kinetic experiment looks at the difference between starting materials and the rate-determining transition state. One way that the two prospective rate-determining transition states differ from starting material is in the cleavage of the phosphate-carbon bond; in the first TS, this bond hasn't yet changed, but in the second it is breaking:



This might be a good place to do an <sup>18</sup>O isotope effect study on the circled oxygen. There should be no isotope effect for the first TS, but a 1° KIE in the second.