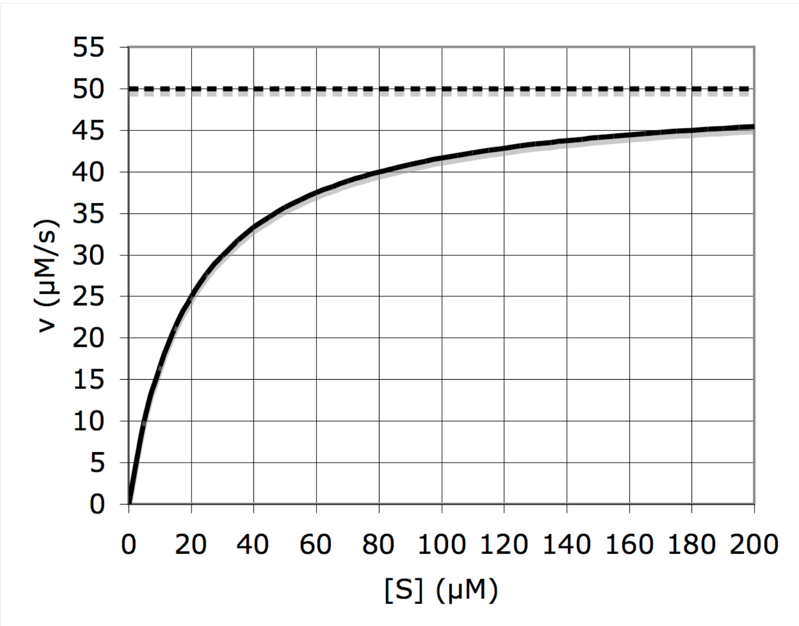
Kinetics Quiz – Chem 391 – Fall 2007 Name: ______________________________

1. Consider the plot of an enzyme-catalyzed reaction, where $[E]_{tot}$ is 10 μM.

Give values, with units, for: K_m 20 μM V_{max} __50 μM/s__ k_{cat} 5 s^{-1}

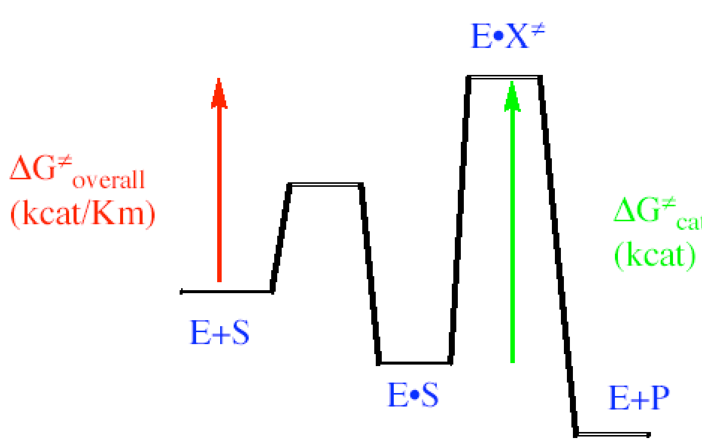


2. On the following reaction profile, corresponding to the Michaelis-Menten mechanism.

a. Identify the E+S, E•S, E•X‡ and E+P states.

b. Identify the free energy change associated with k_{cat}.

c. Identify the free energy change associated with k_{cat}/K_m.



3. Given the following data for the conversion of S to P:

$k_{uncat} = 1 \times 10^{-7}\ s^{-1}$
$k_{cat} = 1 \times 10^{3}\ s^{-1}$
$K_m = 1 \times 10^{-3}$ M

a. What is the relative stabilization of the transition state vs. the substrate by the enzyme? Give answer in kcal/mol at 298 K (R = 0.001987 kcal/mol•K).

$\Delta\Delta G^{\ddagger} = -RT\ln(k_{cat}/k_{uncat}) = -RT\ln(10^{10}) = -14$ kcal/mol

b. What is the dissociation constant for the transition state from the enzyme?

$K_d(X^{\ddagger}) = k_{uncat}/(k_{cat}/K_m) = 10^{-13}$ M

c. Is the catalyzed reaction operating at the diffusion limit?

No, k_{cat}/K_m is $10^6\ M^{-1}s^{-1}$, while the diffusion limit is > $10^8\ M^{-1}s^{-1}$

4. Are transition state analogs likely to be competitive or non-competitive inhibitors. Explain in one sentence.

Competitive inhibitors, because they bind in the active site and displace substrates.