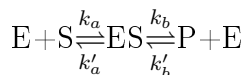


assignment 2

(due before class on 23 Oct 2020)

1. Derive an expression for the rate of an Enzyme catalysed reaction using the modified Michaelis-Menten mechanism:



Show that at the initial stages, when $[S] \gg [P]$, the expression reduces to the usual Michaelis-Menten rate expression.

2. Hydrogen iodide undergoes decomposition into $H_2 + I_2$, when irradiated with radiation having a wavelength of 207 nm. When 1 J of energy is absorbed, 440 μg of HI is decomposed. How many molecules of HI are decomposed by one photon of radiation of this wavelength? Suggest a mechanism that is consistent with this result.

3. The hydrolysis of sucrose by the enzyme invertase was followed by measuring the initial rate of change in polarimeter (optical rotation) readings, α , at various initial concentrations of sucrose. the reaction is inhibited reversibly by the addition of urea :

[Sucrose] (mol l ⁻¹)	0.0292	0.0584	0.0876	0.117	0.175	0.234
initial rate $\frac{d\alpha}{dt} = v_0$	0.182	0.265	0.311	0.330	0.372	0.371
initial rate (2M urea), v'_0	0.083	0.119	0.154	0.167	0.192	0.188

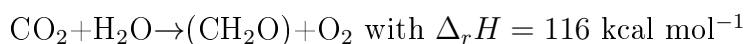
(a) Make a simple plot of the data in the absence of urea and determine the Michaelis constant for this reaction.

(b) Carry out a suitable analysis of the data in the presence of urea and determine whether urea is a competitive or a non-competitive inhibitor.

4. The longest wavelength absorption band of chlorophyll a peaks *in vivo* at $\lambda = 680$ nm.

(a) For photons with $\lambda = 680$ nm, calculate the energy in J photon⁻¹ and in J einstein⁻¹. (1 Einstein=energy in 1 Avogadro number of photons).

(b) CO₂ fixation in photosynthesis can be represented as



What is the minimum number of Einsteins of radiation that need to be absorbed to provide the energy needed to fix 1 mol of CO_2 .

(c) Experimentally, the number of photons required to fix 1 mol of CO_2 is 8 or 9.

What is the photochemical quantum yield?