Michaelis-Menten Kinetics

The reaction of fructose-6-phosphate isomerase was monitored using radioactively labeled substrate. V_{max} = 4240 μMs^{-1} when the enzyme concentration was 1.2 x 10^{-7} M. The initial rate was measured using the following substrate concentrations. Calculate K_m and k_{cat} for this enzyme.

V_0 (μMs^{-1})	620	1210	1540	2120	3460
S (x 10^{-3} M)	1.0	2.2	3.2	5.6	24.8

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Solution: k_{cat} is calculated as follows:

$$k_{cat} = \frac{V_{max}}{[E]_0} = \frac{4240\ x\ 10^{-6}\ Ms^{-1}}{1.2\ x\ 10^{-7}\ M} = 35{,}300\ s^{-1}$$

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Solution: To calculate K_m we use the observation that K_m is equal to the substrate concentration that gives ½ of V_{max}.

$$K_m = [S] \ when \ \ V_0 = \frac{V_{max}}{2}$$

In the table we find the entry at which V_0 = 2120 μMs^{-1} and then use the substrate concentration at that value.

$$K_m = 5.6 \text{ x } 10^{-3}\text{M}$$

Note that the best way to obtain the value would be to fit the data set to a non-linear model of the Michaelis-Menten equation. However, the above method is acceptable as a short cut for working problems in this course.