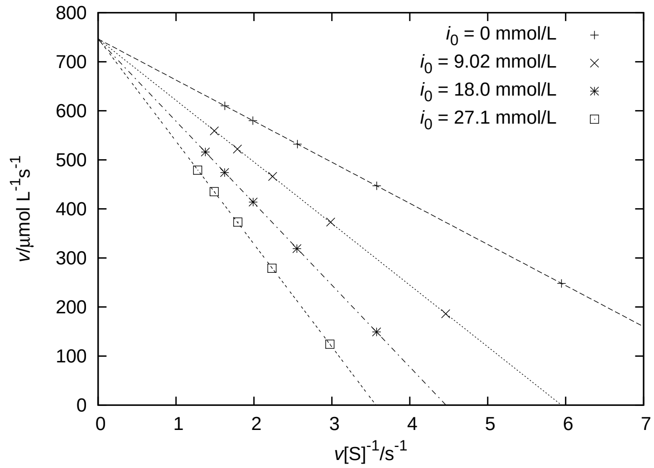
Chemistry 2710 Solutions to the Problem Set on Enzyme Inhibition

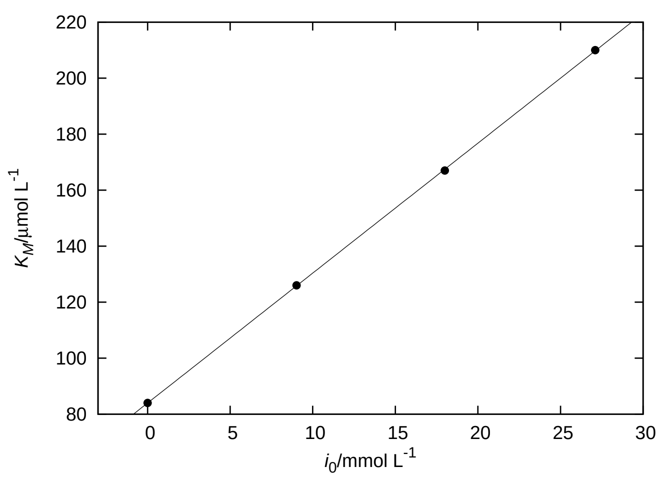
1. We start by drawing Eadie-Hofstee graphs of the four data sets:



Note the common intercept, which is expected for competitive inhibition. The following data were obtained by linear regression:

$i_0/\text{mmol L}^{-1}$	$K_M/\mu\text{mol L}^{-1}$	$v_{\max}/\mu\text{mol L}^{-1}\text{s}^{-1}$
0	84	746
9.02	126	747
18.0	167	746
27.1	210	747

We can average the last column of data and estimate $v_{\max} \approx 747\,\mu\text{mol L}^{-1}\text{s}^{-1}$. If we plot the K_M's vs i_0, we get the following graph:



The slope and intercept are, respectively, $K_S/K_I = 4.64\times10^{-3}$ and $K_S = 84\,\mu\text{mol/L}$. Thus, $K_I = 18\,\text{mmol/L}$.

2. If you create Eadie-Hofstee plots for each inhibitor concentration, you should get the following data:

$[\text{E4P}]/\mu\text{mol L}^{-1}$	$v_{\text{max}}/\mu\text{mol g}^{-1}\text{min}^{-1}$	$K_M/\mu\text{mol L}^{-1}$
0	677	748
1.5	691	1376
3	501	954
4.5	521	2195
6	467	4284

The v_{max} isn't constant, so that rules out competitive inhibition. (I would expect the v_{max} to show a more consistent trend than this, so experimental errors are probably causing some trouble getting accurate values for the intercepts of the Eadie-Hofstee plots. However, the overall trend of v_{max} decreasing with increasing [E4P] is clear.) If we had uncompetitive inhibition, K_M would decrease with increasing [E4P]. However, the trend runs the other way, give or take some experimental difficulties around 1.5–3 μmol/L E4P. Thus, it can't be uncompetitive inhibition either.

Incidentally, if you actually draw the Eadie-Hofstee plot (which you should), you'll see that the data are pretty messy. It's often difficult to get great data in some of these experiments. I should also note that there are one or two suspicious points that we might think about throwing out from the data set. This wouldn't affect our overall conclusion.