

Exercise 59

The Michaelis-Menten equation for the enzyme chymotrypsin is

$$v = \frac{0.14[S]}{0.015 + [S]}$$

where v is the rate of an enzymatic reaction and $[S]$ is the concentration of a substrate S . Calculate $dv/d[S]$ and interpret it.

Solution

Use the quotient rule to differentiate v with respect to $[S]$.

$$\begin{aligned}\frac{dv}{d[S]} &= \frac{d}{d[S]} \left(\frac{0.14[S]}{0.015 + [S]} \right) \\ &= \frac{\left[\frac{d}{d[S]} (0.14[S]) \right] (0.015 + [S]) - \left[\frac{d}{d[S]} (0.015 + [S]) \right] (0.14[S])}{(0.015 + [S])^2} \\ &= \frac{(0.14)(0.015 + [S]) - (1)(0.14[S])}{(0.015 + [S])^2} \\ &= \frac{0.0021}{(0.015 + [S])^2}\end{aligned}$$

$dv/d[S]$ is the rate of change of the reaction rate with respect to an increase of substrate concentration.