Enzyme inhibition

A simple noncompetitive inhibitor of acetylcholinesterase binds to the enzyme to affect V_{max} only; it does not affect K_M. Given that the inhibition constant is $K_I = 2.9 \times 10^{-4}$ M, what concentration of inhibitor is needed to give a 90% inhibition of the enzyme.

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Solution: For a noncompetitive inhibitor we have

$$V = \frac{V_{max}}{\alpha}$$

Since the inhibition is 90% we conclude the initial rate is 10% of V_{max}.

$$0.1\, V_{max} = \frac{V_{max}}{\alpha}$$

Enzyme inhibition

This simplifies to

$$0.1 = \frac{1}{\alpha}$$

Therefore,

$$\alpha = 10 = 1 + \frac{[I]}{K_I}$$

$$\frac{[I]}{K_I} = 9$$

Finally, the inhibitor concentration is

$$[I] = 9K_I = 9(2.9\ x\ 10^{-4}\ M) = 2.61\ x\ 10^{-3}\ M$$