CONCEPT: MICHAELIS-MENTEN EQUATION

●*Michaelis-Menten* (*MM*) *Equation*: mathematically describes the _____ rates (V_0) of enzyme-catalyzed reactions.

□ Mathematically relates _____ to [___] via the V_{max} & the _____.

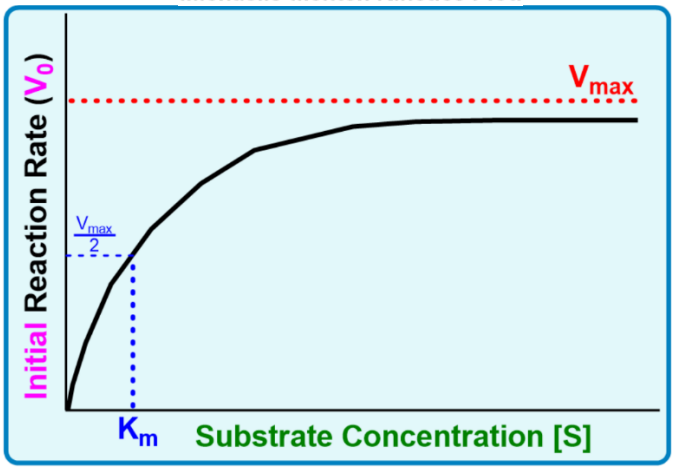
●MM-equation describes the rectangular _____ shape of the curve in a typical enzyme kinetics plot (V_0 vs. [S]).

□ Equation for a *rectangular hyperbola* curve is: $y = \frac{aX}{b + X}$

□ MM-equation simply _____ kinetics variables into the rectangular hyperbola equation.

Rectangular Hyperbola Equation:	Michaelis-Menten Equation:
$y = \frac{aX}{b + X}$	$V_0 = \frac{[\ ]}{+\ [\ ]}$

Michaelis-Menten Kinetics Plot:



EXAMPLE: Consider the following enzyme kinetics data for the enzyme catalyzed reaction of A → B.

[A], µM	V_0 , µmoles/min
0.05	0.08
0.1	0.16
0.5	0.79
1	1.6
5	7.3
10	13
50	40
100	53
5,000	79
10,000	80
20,000	80

A) What is the K_m of the enzyme? _____

B) What is the value of V_0 when [A] = 43.

PRACTICE: A) Suppose the [S] = $10K_m$. Use the Michaelis-Menten equation to determine what percentage of the V_{max} will be equal to the value of V_0.

B) Now suppose the [S] = $20K_m$. Use the Michaelis-Menten equation to determine what percentage of the V_{max} will be equal to the value of V_0. What conclusion can be made from these calculations?

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PRACTICE: Which of the following statements about a V_0 vs. [S] plot for a Michaelis-Menten enzyme is false?

a) As [S] increases, V_0 also increases.

b) At very high [S], the curve becomes a horizontal line that intersects the y-axis at K_m.

c) K_m is the [S] at which $V_0 = ½ V_{max}$.

d) The shape of the curve is a hyperbola.

PRACTICE: What is the ratio of [S] to K_m ($\frac{[S]}{K_m}$) when the V_0 of an enzyme-catalyzed reaction is 80% of the V_{max}?

a) 1. b) 2. c) 3. d) 4. e) 5.

PRACTICE: An enzyme-catalyzed reaction was carried out with a [substrate] initially 1000 times greater than the K_m for that enzyme. After 9 minutes, 1% of the total substrate was converted into 12 µmoles of product. If in a separate experiment, one-third as much enzyme and twice as much substrate had been combined, how long would it take for the same amount of product (12 µmoles) to be formed?

a) 1.5 min. b) 13.5 min. c) 27 min. d) 3 min. e) 6 min.

PRACTICE: An enzyme catalyzes a reaction at a velocity of 10 µmol/min when all enzyme active sites are occupied with substrate. The K_m for this substrate is 1×10^{-5} M. Assume that Michaelis-Menten kinetics are followed, calculate the initial reaction velocity (V_0) when:

A) [S] = 1×10^{-5} M. V_0 = _____ B) [S] = 1×10^{-2} M. V_0 = _____