

## CONCEPT: CALCULATING $K_m$

•  $K_m$  can also be calculated in \_\_\_\_\_ ways.

1)  $K_m$  is also calculated by algebraic \_\_\_\_\_ of the Michaelis-Menten or Lineweaver-Burk equations.

EXAMPLE: Algebraically rearrange the MM-equation to solve for  $K_m$ .

**Michaelis-Menten Equation:**

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


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$$V_0 (K_m + [S]) = [S] V_{\max}$$


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


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

Reciprocals

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**Lineweaver-Burk Equation:**

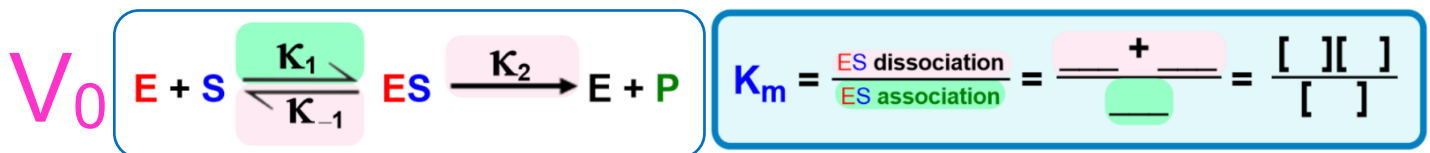
$$\frac{1}{V_0} = \frac{K_m}{V_{\max}} \left( \frac{1}{[S]} \right) + \frac{1}{V_{\max}}$$

Algebraic Rearrangement

2)  $K_m$ : ratio of the sum of an ES-complexes' two \_\_\_\_\_ rates ( $k_{-1}$  &  $k_2$ ) over its association rate ( $k_1$ ).

□ Additionally, this also correlates with the ratio of [ ]/[ ] over [ ].

□ Small  $K_m$  means \_\_\_\_\_ ES-complex dissociation and \_\_\_\_\_ ES-complex formation.



EXAMPLE: The following rate constants were measured for a simple enzyme-catalyzed reaction. Determine the  $K_m$ .

$$k_1 = 2 \times 10^8 \text{ M}^{-1}\text{s}^{-1}, \quad k_{-1} = 1 \times 10^3 \text{ s}^{-1}, \quad k_2 = 5 \times 10^3 \text{ s}^{-1}$$

- $3 \times 10^{-5} \text{ M}$ .
- $2.5 \times 10^{-2} \text{ M}$ .
- $3 \times 10^5 \text{ M}$
- $4.0 \times 10^{-4} \text{ M}$ .

**CONCEPT: CALCULATING  $K_M$**

**PRACTICE:** To determine the  $K_m$  from a Lineweaver-Burk plot you would:

- a) Multiply the reciprocal of the x-axis intercept by -1.
- b) Multiply the reciprocal of the y-axis intercept by -1.
- c) Take the reciprocal of the x-axis intercept.
- d) Take the reciprocal of the y-axis intercept.

**PRACTICE:** The  $V_{max}$  for an enzyme is 9 mg/min. Calculate the  $K_m$  if the  $[S] = 5$  mM when the  $V_0 = 3$  mg/min.

- a) 100 M.
- b) 10 M.
- c) 10 mg.
- d) 10 mM.

**PRACTICE:** Calculate the  $K_m$  of an enzyme using Michaelis-Menten kinetics if the forward rate constant for ES formation is  $4.3 \times 10^6 \text{ M}^{-1}\text{s}^{-1}$ , the reverse rate constant for ES dissociation into  $E + S$  is  $2.4 \times 10^2 \text{ s}^{-1}$ , and the forward rate constant for ES dissociation into  $E + P$  is  $1.2 \times 10^3 \text{ s}^{-1}$ .

- a)  $3.35 \times 10^{-4} \text{ M}^{-1}$ .
- b)  $3.58 \times 10^3 \text{ M}$ .
- c)  $3.85 \times 10^3 \text{ M}^{-1}$ .
- d)  $3.35 \times 10^{-4} \text{ M}$ .