

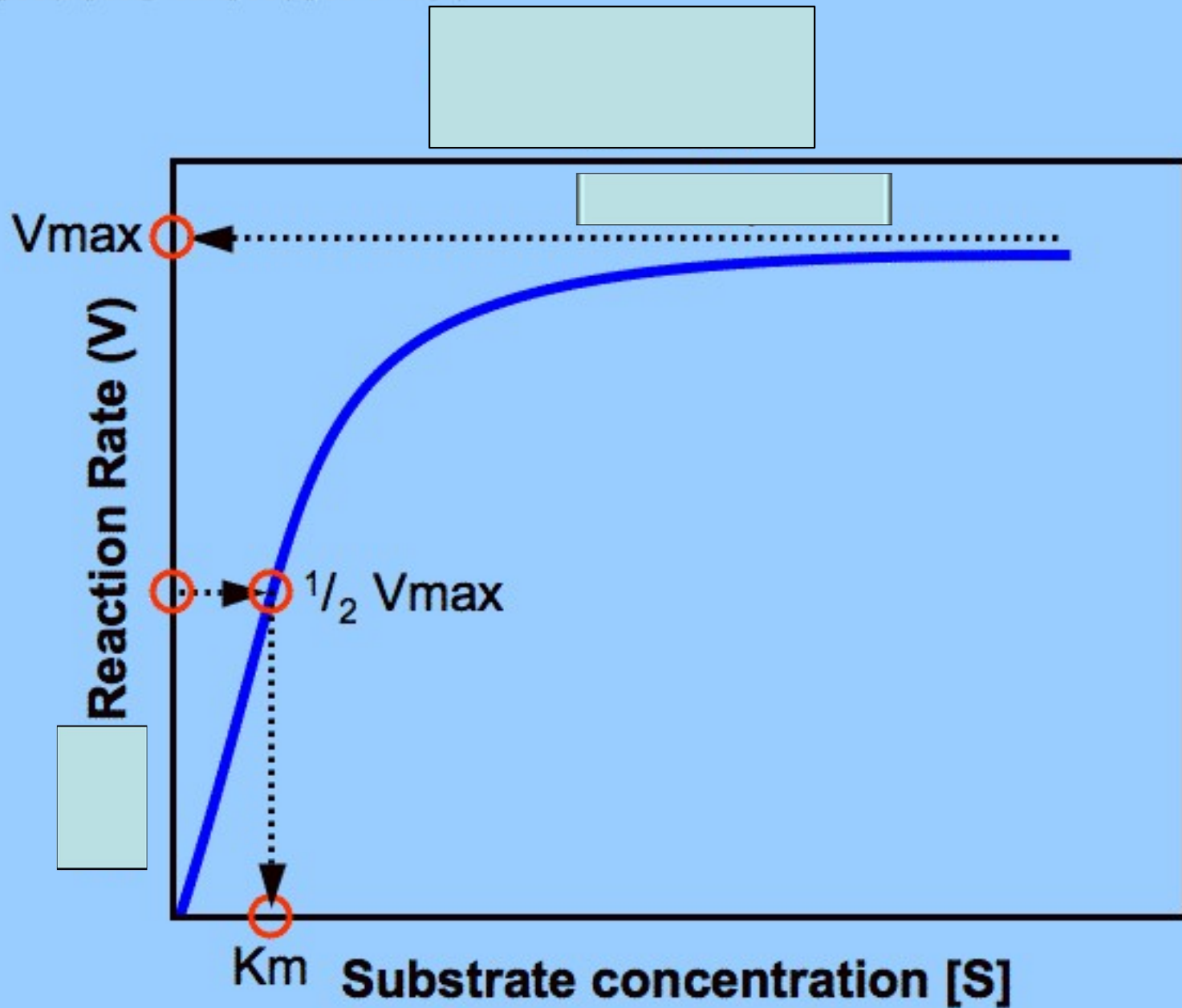
Michaelis-Menten Constant (K_m value & Its Significance)

In an enzyme catalyzed reaction when there is large excess of substrate and the enzyme concentration is held constant, if substrate concentration (S) is plotted against velocity (V) or reaction rate, a hyperbolic curve is obtained (see figure). This type of plot is also known as saturation plot.

In the beginning, there is approximately direct proportionality between substrate concentration and reaction rate until the enzyme concentration becomes limiting and a steady state is obtained.

In this situation addition of more substrate will not increase reaction rate because all the active sites of the enzyme are saturated with substrate molecules and the rate of reaction will increase only by addition of more enzyme.

Michaelis Menten Plot



The concentration of substrate required to half saturate the enzyme or in other words to cause half the maximal reaction rate ($1/2 V_{max}$) called as Michaelis Constant or Michaelis-Menten Constant and is denoted by K_m .

Michaelis constant is a reflection of the affinity of enzyme for its substrate and is characteristic of a particular enzyme-substrate system. The smaller the value of K_m , the more strongly the enzyme binds the substrate.

Kinetic values of enzyme catalyzed reactions are usually measured under steady state conditions and described by a simple expression called Michaelis-Menten, equation.

$$V = V_{\max} [S] / K_m + [S]$$

where,

V → velocity or reaction rate

V_{\max} → maximum velocity or maximal reaction rate

S → Substrate concentration

K_m → Michaelis constant.

K_m values range widely but most lie between 0.1 and 0.000001 M.

K_m Values for Some Enzymes with Respective Substrates

<i>Enzyme</i>	<i>Substrate</i>	<i>K_m (mM)</i>
Hexokinase (brain)	ATP	0.4
	D-Glucose	0.05
	D-Fructose	1.5
Carbonic anhydrase	HCO ₃ ⁻	26
Chymotrypsin	Glycyltyrosinylglycine	108
	N-Benzoyltyrosinamide	2.5
β-Galactosidase	D-Lactose	4.0

Significance of Michaelis-Menten Constant:

- (i) By knowing the K_m value of a particular enzyme-substrate system, one can predict whether the cell needs more enzymes or more substrate to speed up the enzymatic reaction.
- (ii) If an enzyme can catalyze a reaction with two similar substrates (e.g., glucose and fructose) in the cell, it will prefer that substrate for which the enzyme has lower K_m value.

(iii) K_m value gives an approximate measure of the concentration of substrate of the enzyme in that part of the cell where reaction is occurring.

Source:

1. Plant Physiology by Taiz & Zeiger (2015)
2. Biochemistry by Stryer (2016)