CONCEPT: INITIAL VELOCITY

●Biochemists mainly focus on _____ rates of enzyme-catalyzed reactions, since rates naturally *decrease* over time.

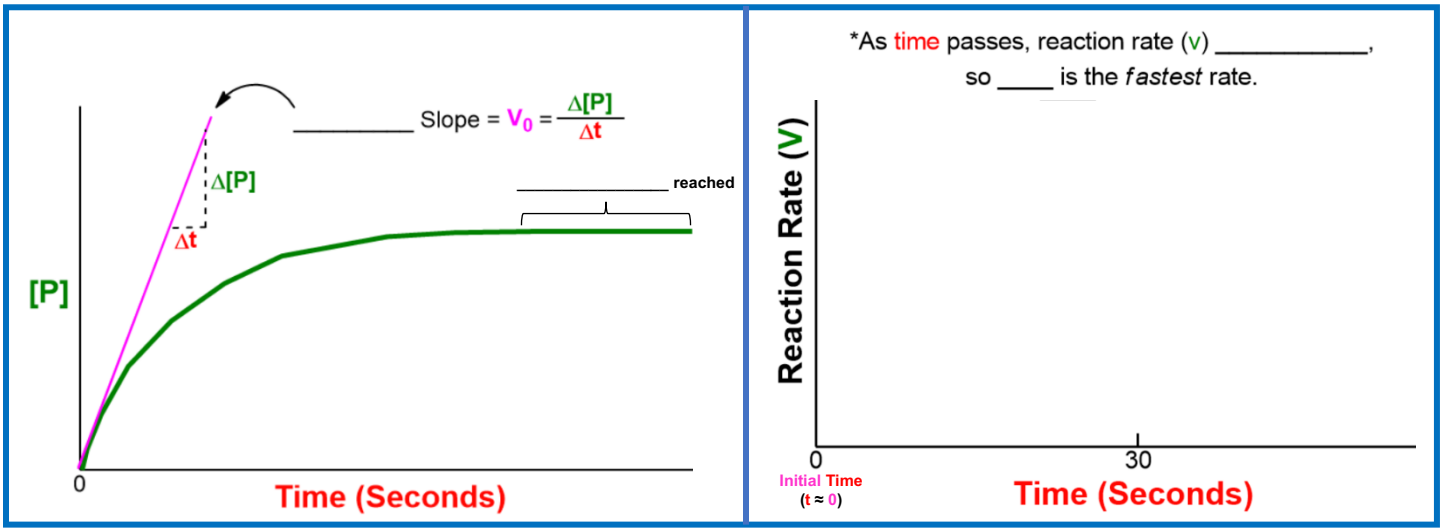
●As a reaction proceeds over time, its rate _____ because [Substrate] decreases over time (converted to products).

□ Also, the _____ reaction (Substrate ← Product) becomes a factor as [Product] accumulates over time.

●_____ velocity (V_0): velocity at beginning of a reaction where [S] is highest & the reverse reaction is *negligible*.

□ Initial velocity (V_0) is the *best chance* a reaction has at _____ its maximum velocity (V_{max}).

EXAMPLE: Draw in the curve for the second graph below: Reaction Rate (V) vs Time (sec).



●*All enzyme kinetics* _____ assume the reaction velocity measured is initial velocity (V_0).

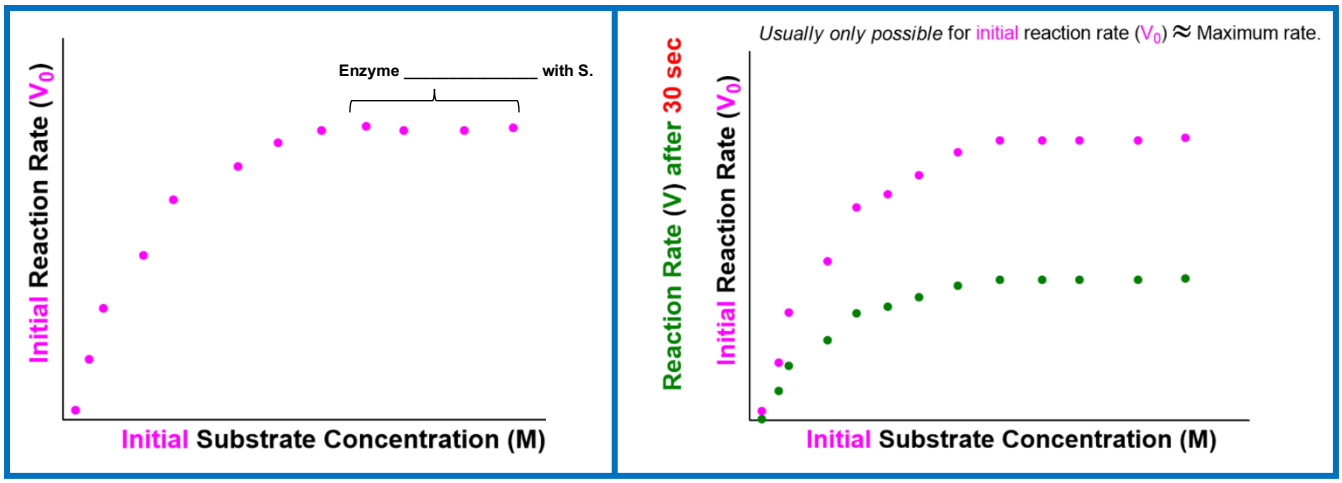
□ This makes it easier to _____ reaction velocities of different enzyme-catalyzed reactions.

Enzyme Kinetics Plot (V_0 vs [S])

●Enzyme Kinetics Plots: graph initial reaction velocity (V_0) on ___-axis and [substrate] on ___-axis.

□ *Note: V_0 occurs at _____ specific period of time early on, so we _____ monitor V_0 over time (time ≠ x-axis).

□ V_0 varies with [____] when all variables influencing reaction rate (temperature, pH, [____], etc.) are *constant*.



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PRACTICE: Why is the initial velocity (V_0) the best chance a reaction has at approaching its maximum velocity (V_{max})?

a) [Substrate] decreases over time.
b) Reverse reaction from Reactant ← Product becomes more significant over time.
c) Reaction rates increase over time.
d) a and b.
e) All the above.

PRACTICE: Calculate the initial reaction rate for A → B, given that $[A]_i$ = 9.6 M, $[B]_i$ = 0 & $[A]_f$ after 0.01 μsec = 9.14 mM.

a) 46 M/s.
b) 959 M/s.
c) 9.59×10^8 M/s.
d) 4.6×10^7 M/s.

PRACTICE: Imagine that you're setting up an experiment to measure the kinetics of an enzyme. Which option below indicate reasons for why it's important to measure the enzyme's initial velocity immediately after starting the reaction?

a) To capture the velocity of the reaction in the microseconds before the [ES] has reached steady-state.
b) To measure the forward reaction velocity with a negligible contribution from the reverse reaction.
c) To isolate the effect of the enzyme from the uncatalyzed reaction.
d) To measure the velocity of the reaction with a known $[E]_T$ since enzymes are irreversibly destroyed during catalysis.
e) To measure the velocity of the reaction with a known [S] before it begins to change significantly over time.
f) a, b and e.
g) b and e.

PRACTICE: In the graph below, why does the curve have a steep incline at first that gradually declines to a horizontal line?

a) Because the substrate becomes an inhibitor at high concentrations.
b) Because the substrate is able to stimulate the enzyme at low concentration.
c) Because the transition state complex is more unstable at low substrate concentrations.
d) Because the available enzyme is saturated with substrate at high enough concentrations.
e) Because the Gibbs free energy approaches zero at high substrate concentrations.