CONCEPT: STEADY-STATE CONDITIONS

●During an enzyme-catalyzed reaction, the [____] quickly reaches a constant value (referred to as _____-state).

□ Steady-state is an important _____ that Biochemists make when studying enzyme kinetics.

□ Pre-Steady-State: describes conditions that exist _____ the [ES] reaches a stable point.

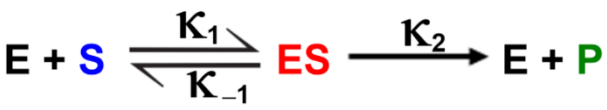
Pre-Steady-State

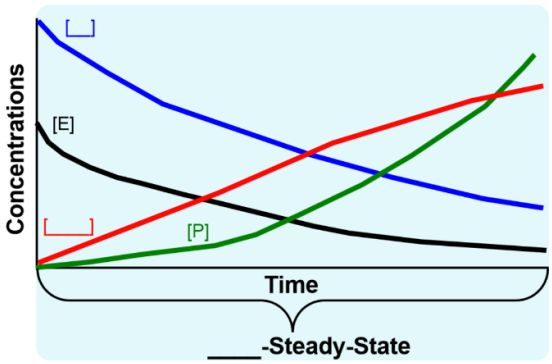
●Initially, at the very beginning of an enzyme-catalyzed reaction, the following ___ conditions exist for just a few μ-seconds:

1) [**S**] is _____. 2) Free [**E**] is _____. 3) [**ES**] is _____. 4) [**P**] is _____.

●As the enzyme-catalyzed reaction begins, concentrations of substances above *change* in _____ directions.

□ In the pre-steady-state, [**ES**] continuously _____ *until* a period called *steady-state* is reached.





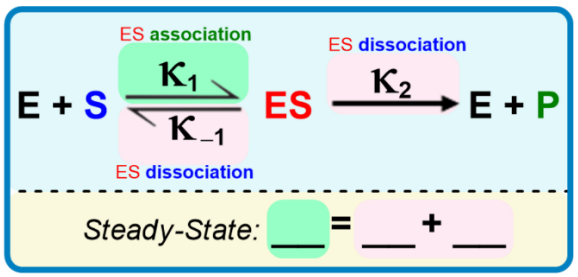
Steady-State Conditions

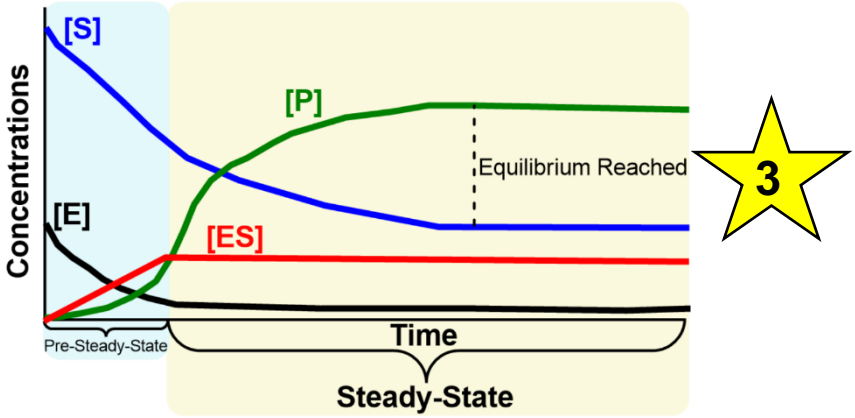
●_____-state: a period during an enzyme-catalyzed reaction where the [**ES**] stays the _____.

□ Rate of ES-complex ***association*** _____ the rate of ES-complex ***dissociation***.

□ If [**ES**] remains _____, that means that $V_1 = V_{-1} + V_2$

□ The Michaelis-Menten enzyme kinetics _____ is derived from these *steady-state* conditions.



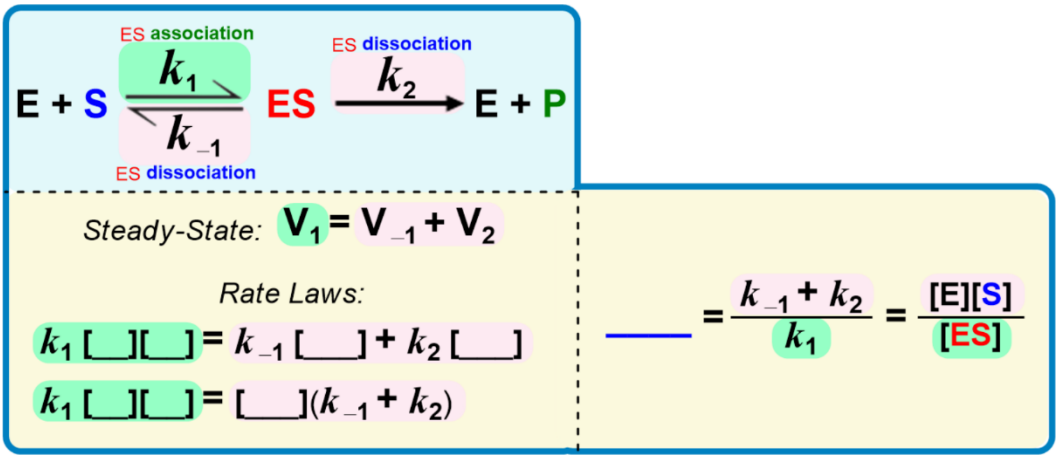


PRACTICE: True or false: A reaction system at steady-state must also be at equilibrium. a) True. b) False.

CONCEPT: STEADY-STATE CONDITIONS

K_m Derived Under Steady-State Conditions

●Recall: Both the _____ & the Michaelis-Menten equation are derived/defined under *steady-state conditions*.



PRACTICE: The steady state assumption, as applied to enzyme kinetics, implies:

a) $K_m = K_d$.

b) $K_m = K_s$

c) $k_{-1} = k_1 + k_2$.

d) The K_m is equivalent to the cellular substrate concentration.

e) The maximum velocity (V_{max}) occurs when the enzyme is saturated.

f) The ES complex is formed and broken down at equivalent rates.

PRACTICE: Draw the curves that show the appropriate relationships between the variables in each of the plots below for a simple enzyme-catalyzed reaction that follows Michaelis-Menten kinetics.