Enzymes – globular proteins (exceptions – RNA, membrane proteins)

Catalyze a chemical reaction
- use reaction terminology
  nucleophile – attack
electrophile – good leaving group
- accelerate ______________
do not change ______________

Benefits to living organisms
1) __________ reaction rates
2) __________ reaction condition
3) __________ reaction specificity
4) __________ for regulation

Enzyme Kinetics

Reaction – Substrate converted into product
Rate constant with forward and reverse reaction

Rate equation –
Reaction velocity

Reaction order – determined experimentally
  vary one [reactant], hold the rest constant
  plot to find the reaction order
the exponent in the rate equation
how many molecules react in the slowest step

**differential rate equation**  \( - \) rate dependence on [ ]
**integrated rate equation**  \( \) concentration at time = t
expresses the change in ___________ per ________
it represents the __________ velocity
it can be observed as a ___________ or __________
the rate constant is a "proportionality" constant
reaction order is determined ________________
zero, first, second, pseudo zero, pseudo first
plot of velocity vs [S]
units of velocity
units of rate constants
differential rate equation – rate at a particular concentration of S
integrated rate equation – concentration of S at a particular time

Why does the line curve?
a) ___________________________
b) ___________________________
c) ___________________________

Enzyme Catalyzed Reactions
differ from chemical "test tube" reactions in that there is a __________
examine a graph of v0 vs [S]
generation of data requires obtaining the initial velocity at several [S]
Note the difference between the line for a "test tube" reaction and an enzyme catalyzed reaction
A graph of [P] vs time is not the same as a graph of v0 vs [S], even though they have the same shape

Michaelis-Menton Equation
Relates the __________ to __________ for an __________ catalyzed reaction
Assumptions:
1) ___________________________
2) ___________________________
3) ___________________________
4) ___________________________
[ES] is important in determining the reaction rate since k2 is often smaller than k1 and k-1
Km is a function of rate constants, but the exact composition depends on the reaction mechanism
5) ___________________________

V0 = Vmax [S]Km + [S] curve shape _____________

Parameters of interest are Vmax and Km
Vmax is the ___________________________
Km is the ___________________________
It is difficult to determine these parameters on a hyperbolic graph
Other more useful graphs

1) Lineweaver-Burk (double reciprocal)
   plot $\frac{1}{V_0}$ vs $\frac{1}{[S]}$
   slope is $\frac{K_m}{V_{max}}$, y-intercept is $\frac{1}{V_{max}}$

2) Hanes plot – multiply by $[S]$
   plot $\frac{[S]}{V_0}$ vs $[S]$
   slope is $\frac{1}{V_{max}}$, y-intercept is $\frac{K_m}{V_{max}}$

3) Eadie-Hofstee – multiply by $V_{max}$
   plot $V_0$ vs $\frac{V_0}{[S]}$
   slope is $-K_m$, y-intercept is $V_{max}$