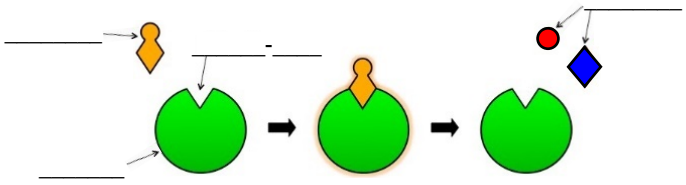
CONCEPT: ENZYMES

●*Enzymes*: globular proteins that _____ (or *speed up* the *rate*) of chemical reactions _____ being consumed.

□ _____ are enzymes that are *RNA catalysts*.

□ Reactants (or _____) *specifically* bind to an enzyme's _____ *site*.

EXAMPLE: Fill-in the blanks.



PRACTICE: Hexokinase uses ATP to convert glucose into glucose-6-phosphate during glycolysis. Which option is true?

a) Hexokinase is a fibrous protein.

b) Hexokinase is permanently altered in the enzymatic reaction.

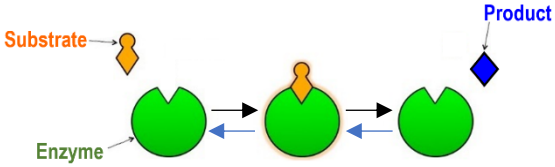
c) Hexokinase is a molecular catalyst.

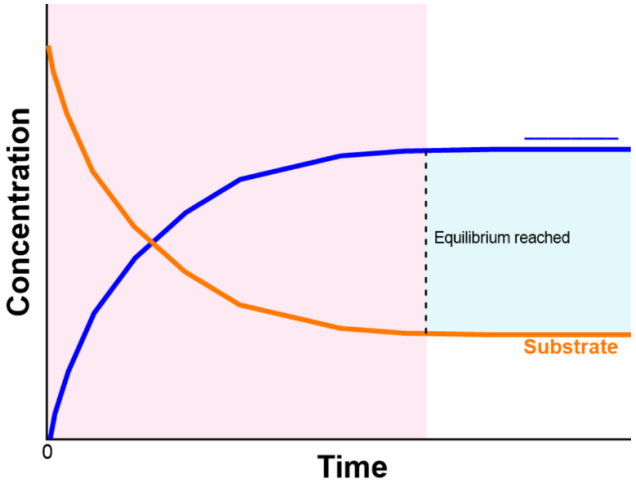
d) Hexokinase & all enzymes are proteins.

Enzymes Get Reactions to Equilibrium Faster

●A common misconception is that enzymes *always* convert _____% of substrate into product; this is not true.

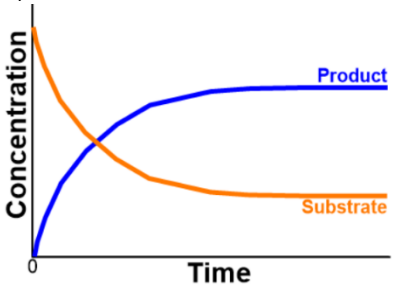
□ Instead, enzymes only help reactions get substrates/products to their _____ concentrations ***faster***!



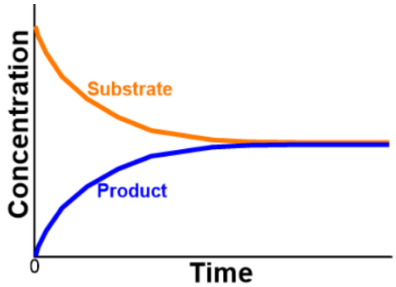


PRACTICE: Which graph below corresponds with a reaction that has an equilibrium constant less than 1 ($K_{eq} < 1$)?

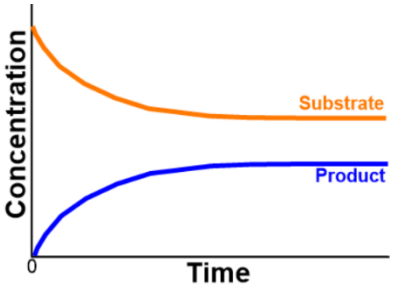
a)



b)



c)



CONCEPT: ENZYMES

PRACTICE: The enzyme catalase converts hydrogen peroxide into water and oxygen gas. Which of the following is true?

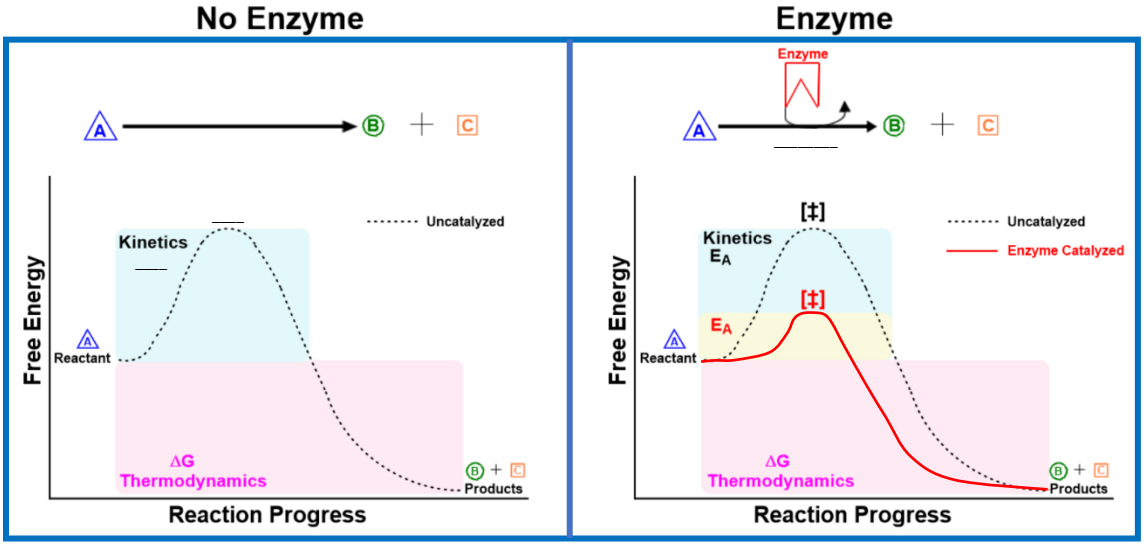
a) All enzymes utilize ATP to catalyze reactions.
b) All hydrogen peroxide is converted to products.
c) Catalase stops catalyzing when reaction reaches equilibrium.
d) Catalase catalyzes forward & reverse reactions at equilibrium.

Enzymes Lower E_A

●Enzymes speed up reactions by lowering their energy of _____ (E_A or $\Delta G^{‡}$).

□ *Energy of Activation*: energy difference between substrates & _____ state required to *initiate* a reaction.

□ *Transition state* (‡): an unstable transient entity at the local _____ peak energy point of a reaction.



●Enzymes do **NOT** affect: 1) the _____ favorability (no change to ΔG) or….

2) the _____ constant (no change to K_{eq}).

PRACTICE: Which of the following is the best description of what an enzyme does?

a) It allows a chemical reaction to proceed extremely fast.
b) It increases the rate at which a chemical reaction reaches equilibrium relative to its uncatalyzed rate.
c) It makes a reaction thermodynamically favorable to allow it to proceed faster.

PRACTICE: Which of the following best describes how enzymes catalyze reactions?

a) Alter the equilibrium constant (K_{eq}) of a reaction.
b) Decrease the thermodynamic free energy (ΔG) of a reaction.
c) Change nonspontaneous reactions into spontaneous reactions.
d) Force reactions to proceed in only one direction.
e) Stabilizing the transition state.
f) c & d.