Enzyme Worksheet

Name_____

Section A: Why does an apple turn brown when peeled?

When an apple is cut, oxygen comes in contact with the fruit's inner tissue and browning occurs. One particular enzyme in the apple cells, polyphenol oxidase, begins breaking down the tissue. This process may be the plant's way of keeping pests away from a cut or broken area. What could you do to stop this browning action? _____

Section B: Enzyme Activity Webquest

Click on "Websites-Cells" page, then select "Enzyme Activity". Go through the animation and answer these questions.

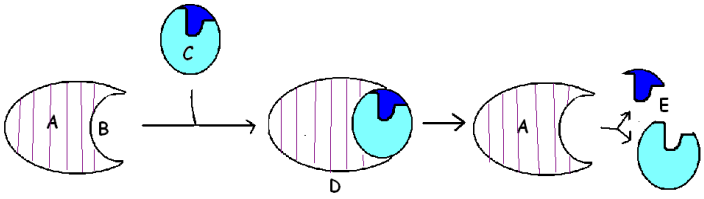
1. Enzymes are _____ that help to _____ chemical reactions in the body.
2. Why are enzymes necessary? _____
3. Enzymes are specific. What does that mean? _____
   _____
4. Enzymes are not changed during a reaction. What does that mean? _____
   _____
5. Why is the shape of an enzyme important? _____
   _____
6. What factors can denature an enzyme? _____
   _____
7. When a protein denatures, what happens to the enzyme? _____
   _____
8. Click on "Why Enzymes?" and play the animations. How is the reaction different without an enzyme and with an enzyme? _____
   _____
9. Click on "Enzyme Menu", then click on "Specificness". Play the animation and explain what is occurring? _____
   _____
10. Click on "Enzyme Menu", then click on "Reusing Enzymes". Play the animation and explain what is occurring. _____
    _____
11. Click on "Enzyme Menu", then click on "Denaturing". Play the animation and explain what is occurring. _____
    _____

Section C: Enzyme Questions

1. Reactants in an enzyme catalyzed reaction are called _____.
2. Which type of macromolecule are enzymes categorized as? _____
3. Identify if the following statements are True or False.
   a. _____ Enzymes are used up during a chemical reaction.
   b. _____ Enzymes speed up reactions.
   c. _____ One enzyme can be used for many different types of reactions.
   d. _____ Enzymes interact with specific substrates.
   e. _____ Enzymes change shape after a chemical reaction.
   f. _____ Enzymes decrease the activation energy.
   g. _____ Enzymes can function inside and outside of cells.
   h. _____ All enzymes are proteins.

4. Enzymes unwind or _____ when placed in extreme pH or temperature conditions.

5. Identify the parts of the diagram.

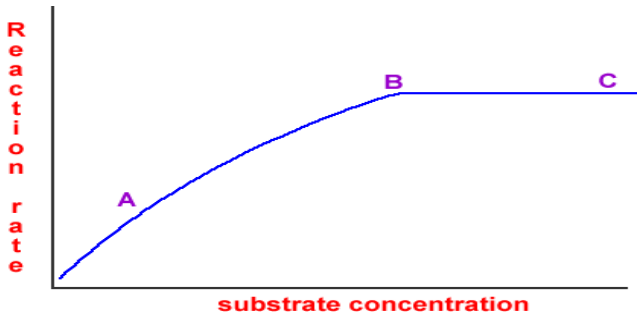


_____ Products
_____ Substrate
_____ Active Site
_____ Enzyme-Substrate Complex
_____ Enzyme

6. Identify if the following external factors will increase, decrease or not change the rate of chemical reaction.
   a. Raising the temperature slightly. _____
   b. Adding more substrate. _____
   c. Changing the pH away from the optimal pH. _____
   d. Boiling temperatures. _____
   e. Adding an inhibitor. _____

7. How does changing an enzyme shape cause it to work poorly or not at all? _____
   _____

8. Explain what is occurring in the graph.
   a. Between A and B
      _____
      _____
      _____
   b. Between B and C
      _____
      _____
      _____



Section D: Enzyme Inhibitors

Watch the video "Enzyme Function & Inhibition". Explain how the non-competitor inhibitor and the competitive inhibitor affect an enzyme. _____
_____
_____
_____

- If you need more information on inhibitors, click on "Websites-Cells" page, then select "Enzyme Animation". Go through the animation "Enzyme Inhibitors".

Section E: Enzyme Denaturation

Click on "Websites-Cells" page, then select "Enzyme Denaturation". Watch the video and explain what happens to an enzyme when it's denatured. _____
_____
_____

- Another video on Protein Denaturation….. https://www.youtube.com/watch?v=SUCgAxI8rhg

Section F: Enzyme Lab

What would happen to your cells if they made a poisonous chemical? You might think they would die, but cells use enzymes to break down these poisonous chemicals into harmless substances. The enzyme Catalase is a common enzyme found in nearly all living organisms. It accelerates the decomposition of hydrogen peroxide H_2O_2. One molecule of catalase can break 40 million molecules of hydrogen peroxide each second.

$2H_2O_2$ + Catalase → $2H_2O + O_2$

Lab 1: Enzyme Activity

1. Add a small piece of room temperature potato into a clean test tube. Place 2 mL of hydrogen peroxide into the test tube. Observe the bubbles; what gas is being released?_____
2. Record the bubble observation. Assume that this reaction is a "4" on the scale.

Lab 2: Temperature

1. Obtain a small piece of potato that has been in the freezer and place it in a clean test tube. Add 2 mL of hydrogen peroxide into the test tube. Observe the bubbles and record your observation.
2. Obtain a small piece of potato that has been boiled and place it in a clean test tube. Add 2 mL of hydrogen peroxide into the test tube. Observe the bubbles and record your observation.

Lab 3: pH

1. Obtain a small piece of potato that has been soaking in acid and place it in a clean test tube. Add 2 mL of hydrogen peroxide into the test tube. Observe the bubbles and record your observation. **CAUTION----Use forceps to remove the potato. DO NOT get the acid on your skin.**

LABS	Rate of Reaction…..how rapidly the solution bubbles Scale from 0-5 (0=slow reaction & 5=fast reaction)
Lab 1 – Potato at room temperature	
Lab 2 – Potato from freezer	
Lab 2 – Boiled Potato	
Lab 3 – Potato in Acid	

Post Lab Questions:

1. What does rate of reaction indicate? _____
   _____
2. Some of these external factors denatured the catalase enzyme. What does denature mean?
   _____
3. Identify these parts of the enzyme-substrate complex.
   Substrate = _____ Products = _____
4. In the room temperature potato, if you poured off the liquid into a second test tube. Assuming the reaction is complete and all the hydrogen peroxide has been broken down by the catalase.
   a. What should the liquid be composed of? _____
   b. Based on your above response, what do you think would happen if you added more potato to this liquid? _____
   c. If you take the used potato from the initial reaction and added 2 mL of hydrogen peroxide, would a reaction occur? Why or why not? _____
      _____

To see the Catalase virtual lab: Click on "Websites-Cell", then on "Enzyme Catalase Lab"

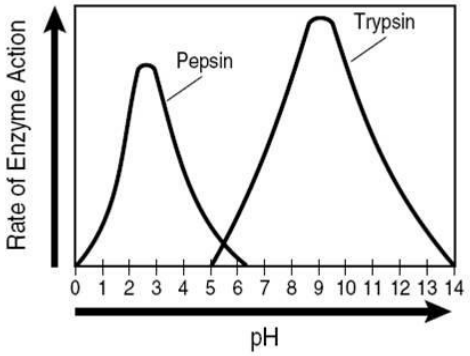
Section G: Concept Check

Match the following words with their definitions.

1. Product ____
2. Active site _____
3. Enzymes _____
4. Catalyst _____
5. Substrate _____
6. Activation energy _____

a. Substances that bring about a chemical reaction without being changed.
b. Amount of energy required for a chemical reaction to occur.
c. Proteins that speed up chemical reactions.
d. Substance formed from the substrate at the end of a chemical reaction with an enzyme.
e. Regions on the surface of enzymes that fit the substrate.
f. Substance that enzymes act upon.

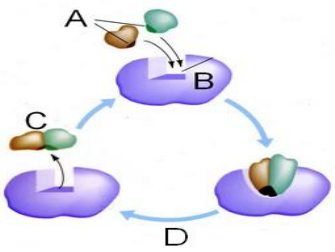
7. Like all proteins, enzymes are denatured by extremes of pH. Each enzyme has a preferred pH range for optimum activity.
   a. State the optimum pH for each enzyme.
      Pepsin _____ Trypsin _____
   b. Pepsin breaks down proteins in the stomach and requires an acidic environment to work. How would pepsin activity be affected if it were put in a neutral solution? _____
      _____



8. Explain how extreme temperatures and pH denature an enzyme.
   _____
   _____

9. Identify the following in the diagram.

   Enzyme _____
   Substrate _____
   Products _____



10. At high temperatures, the rate of enzyme action decreases because the increased heat __.
    a. changes the pH of the system
    b. alters the active site of the enzyme
    c. neutralizes the acids and bases in the system
    d. increase the activation energy
11. An enzyme that hydrolyzes starch will not act upon proteins. This fact is an indication that enzymes are _____.

Practice quiz on Enzymes
http://www.edhsgreensea.net/Biology/taters/enzyme_mc.htm
http://www.sciencegeek.net/Biology/review/U2Enzymes.htm
http://quizlet.com/8126238/test?matching=on&mult_choice=on&tf=on&prompt-with=1&limit=38
http://highered.mheducation.com/sites/007337797x/student_view0/chapter6/animation_quiz_-_how_enzymes_work.html