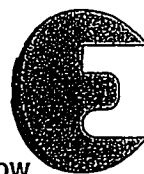


Name: key

Date:

Enzymes Worksheet

This worksheet accompanies *Enzymes.ppt* and *Digestive Enzymes.ppt*



1. a) Fill in the gaps in the following sentences using the words in the box below.

- i) Enzymes are biological catalysts that speed up chemical reactions in living organisms.
- ii) Enzymes are protein molecules, which are made up of long chains of amino acids.
- iii) The sequence and type of amino acids are different in each protein, so they produce enzymes with many different shapes and functions.
- iv) The shape of an enzyme is very important to its function.

different

catalysts

function

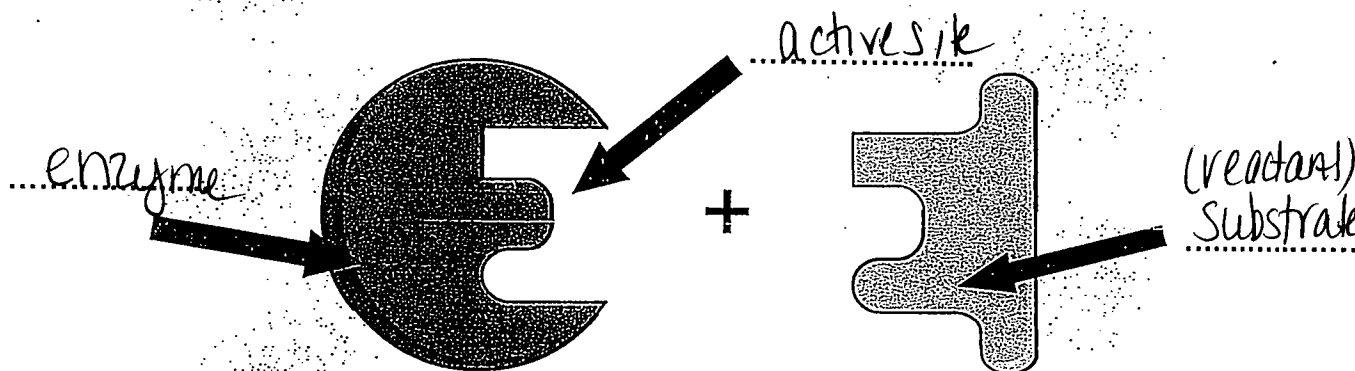
the same

amino acids

b) Enzymes catalyze chemical reactions involved in important processes in the human body. Name one of these processes.

cellular respiration, digestion

c) Label the image below with the following terms: active site, reactant, enzyme.



d) i) What is the common name for the above model?

lock & key model

ii) Label the two components of this model on the above image.

enzyme



Name:

Date:

2. a) Explain what would happen if a reactant molecule with a different shape to the enzyme came into contact with the enzyme's active site.

Competitive inhibitor - ↓ rate of reaction
preventing enzyme from doing
its job

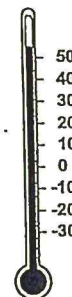


- b) Explain what would happen to a reactant molecule if it came into contact with an enzyme's active site that matched its specific shape. Use the space below to draw and explain what would happen. Use the following terms in your answer: enzyme, reactant complex, products, enzyme, reactant, active site.

1. reactants would bind in the active site of the enzyme, forming an enzyme-substrate complex
2. reactant would be broken down into 2 products
3. enzyme would be re-used

- c) There are many factors that affect the rate of enzyme-catalyzed reactions, including temperature. Name two other factors.

pH, salt concentration
substrate concentration



Name:

Date:

- d) i) What would happen to an enzyme if the temperature and pH changed significantly beyond the enzyme's optimum level?

..... it would change shape or denature

- ii) How would this affect enzyme activity?

..... enzyme would become inactive

3. A group of students decided to carry out an investigation to find out how enzyme activity is affected by temperature changes. They put samples of salivary amylase and starch into two test tubes. Salivary amylase is an enzyme that breaks down starch into maltose. Its optimum temperature for activity is around 37°C.

- a) What do you think happened to the rate of reaction when they increased the temperature of the first test tube to 37°C?

..... ↑ rate of maltose formation

- b) What do you think happened to the enzyme activity when the students decreased the temperature of the second test tube to 0°C?

..... ↓ rate of maltose formation

- c) Explain what an inhibitor is and what it does.

..... inhibitors - slow or stop a reaction from occurring
..... by interfering with substrate-enzyme connection
..... or changes shape of enzyme

4. a) Fill in the missing words in the following text about enzymes and digestion.

Not all enzymes work inside cells in the body.

Digestive enzymes are produced by specialized cells

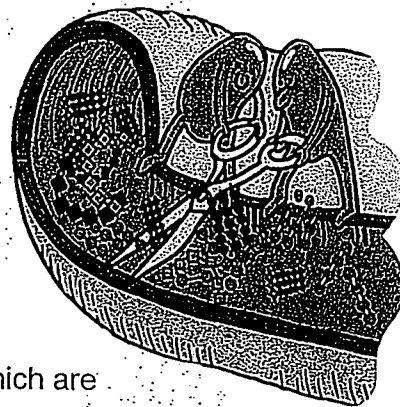
in the pancreas and digestive tract. From there, the enzymes

pass out of the cells, into the blood and small

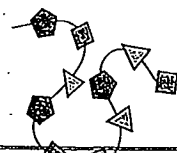
intestine where they come into contact with food molecules.

Here, they catalyze the break down of large molecules, which are

then more easily absorbed by the body.



- b) Write down the name of the nutrient next to the enzyme that breaks it down.
Use the words in the box below.



Name:

Date:

- i) Carbohydrase is an enzyme that breaks down carbohydrates
- ii) Protease is an enzyme that breaks down proteins
- iii) Lipase is an enzyme that breaks down lipids (fat)
- iv) Amylase is an enzyme that breaks down starch

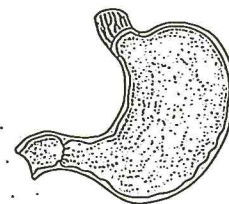


fats sucrose starch proteins carbohydrates hydrochloric acid

✓ The stomach produces hydrochloric acid which increases the acidity of the stomach to the optimum pH for stomach enzymes to digest the food. However, digestive enzymes found in the small intestine are damaged by strongly acidic conditions. How does the body avoid damaging the digestive enzymes in the small intestine with this strongly acidic pH as the food passes out of the stomach?

valves between stomach / small intestine

digestive salts → change shape of protein (enzyme)

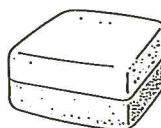
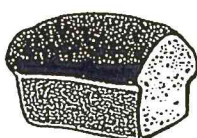


5. a) Biological washing powders contain protein-, fat- and carbohydrate-digesting enzymes to help remove stains. Name one other use for enzymes in the home or industry.

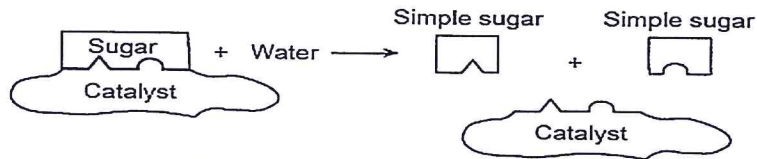
Septic system; meat tenderizers; bread, wine

- b) Give one advantage of using enzymes in industrial manufacturing processes.

textiles; baking bread; beer wine production
tanning



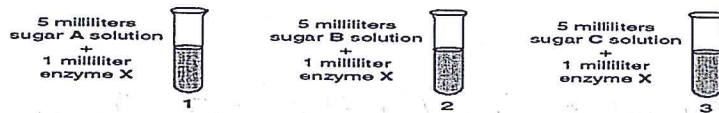
1. The diagram below illustrates a biochemical process that occurs in organisms.



The substance labeled "catalyst" is also known as

- (1) a hormone (3) an antibody
(2) an enzyme (4) an inorganic compound

An investigation was performed to determine the effects of enzyme *X* on three different disaccharides (double sugars) at 37°C. Three test tubes were set up as shown in the diagram below.



At the end of 5 minutes, the solution in each test tube was tested for the presence of disaccharides (double sugars) and monosaccharides (simple sugars). The results of these tests are shown in the table below.

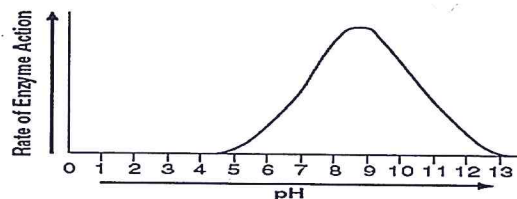
	Test Tube 1	Test Tube 2	Test Tube 3
Monosaccharide	not present	not present	present
Disaccharide	present	present	not present

2. What can be concluded about the activity of enzyme *X* from the data table?

enzyme X works only on disacchande
in test tube 3. (due to dis. not detected means it was broken down into mono.)

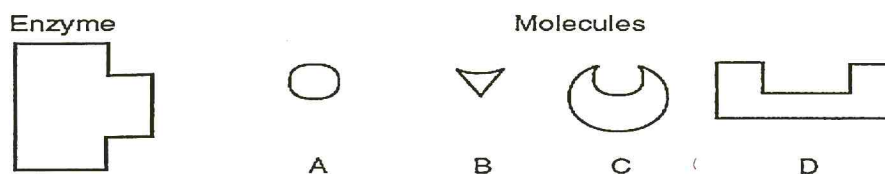
3. A characteristic of hormones and enzymes that allows them to work effectively with other organic molecules is their (1) specific shape (2) small size
(3) concentration of carbon and hydrogen atoms (4) high-energy bonds

4. The effect of pH on a certain enzyme is shown in the graph below.



- At what pH would the enzyme be most effective? (1) above 10
(2) between 5 and 7 (3) between 8 and 10 (4) below 5

Base your answers to questions 5 through 7 on the diagram below that represents a human enzyme and four types of molecules present in a solution in a flask.



5. Which molecule would most likely react with the enzyme? D

6. Explain your answer to question 5. induced fit

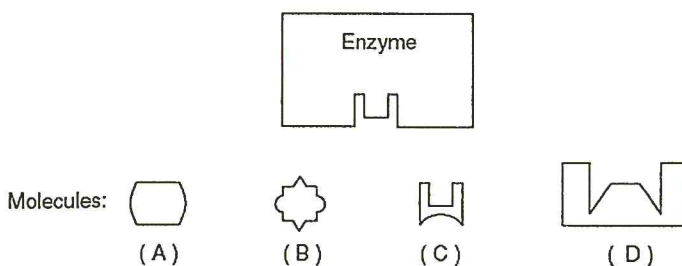
7. State what would most likely happen to the rate of reaction if the temperature of the solution in the flask were increased gradually from 10°C to 30°C.

enzyme would change shape + possibly not "fit" anymore

8. A colony of bacteria growing on a culture medium is successfully synthesizing an organic compound. Which procedure would be *least* likely to have an effect on this synthesis?

- (1) adding more subunits of the organic compound to the medium
- (2) lowering the pH of the medium
- (3) raising the temperature of the colony from 20°C to 30°C
- (4) increasing the number of hormone molecules in the colony

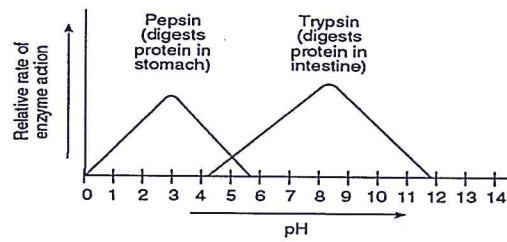
9. An enzyme and four different molecules are shown in the diagram below.



The enzyme would most likely affect reactions involving

- (1) molecule A, only
- (2) molecule C, only
- (3) molecules B and D
- (4) molecules A and C

Use the diagram on the next page and your knowledge of biology to assist you in answering questions 10 and 11 which follow.

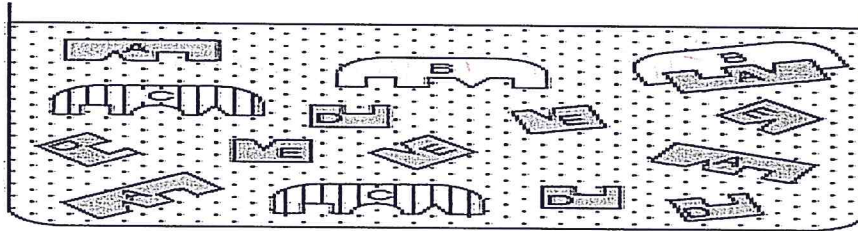


10. Pepsin works best in which type of environment?

- (1) acidic, only (2) basic, only
(3) neutral (4) sometimes acidic, sometimes basic

11. Neither enzyme works at a pH of (1) 1 (2) 5 (3) 3 (4) 13

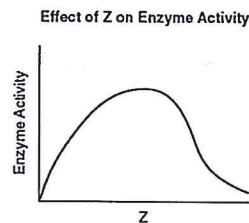
The diagram below represents a beaker containing a solution of various molecules involved in digestion.



12. Which structures represent products of digestion?

- (1) A and D (2) B and E (3) B and C (4) D and E

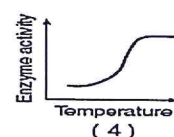
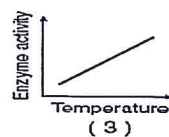
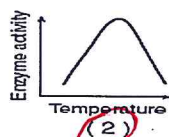
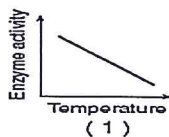
13. An incomplete graph is shown below.



What label could appropriately be used to replace letter Z on the axis?

pH or temp

14. Enzymes have an optimum temperature at which they work best. Temperatures above and below this optimum will decrease enzyme activity. Which graph best illustrates the effect of temperature on enzyme activity?



15-17. Enzyme molecules are affected by changes in conditions within organisms. Explain how a prolonged, excessively high body temperature during an illness could be fatal to humans. Your answer must include:

- the role of enzymes in a human
- the effect of this high body temperature on enzyme activity
- the reason this high body temperature can result in death

enzyme break down molecules. During high fever, enzyme will change shape & not allow break down of foods to occur. No food = no life breakdown

18. Define the term **denatured**.

↳ shape changes

19. Define the term **active site**.

↳ place on enzyme where substrate matches up

20. Define the term **substrate**.

substance an enzyme works on

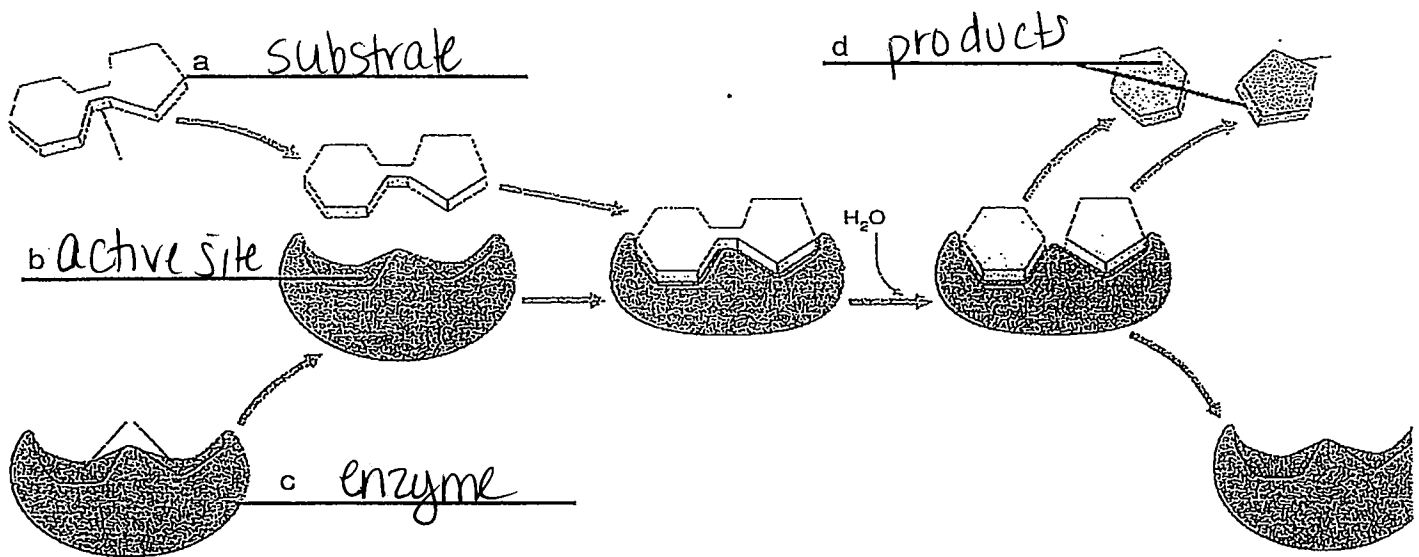
21-24. Correctly complete the following chart.

Organic Compound Class	Subunit or Building Block of Compound	Function(s) or Example(s) of the Compound
proteins	a.a.	Antibodies, enzymes, some hormones ... the function of the compound is controlled by its shape
Lipids	Fatty acids and glycerol	Energy storage, cushioning, and insulation
Carbohydrates	monosaccharides	Includes starches and sugars which are used as energy sources and cellulose which makes up cell walls in plants
nucleic acids	Nucleotides	Has the genetic code in the nucleus and is involved in protein synthesis at the ribosomes; DNA and RNA are examples

Key

ENZYME PRACTICE

1. Label the diagram



2. Answer true or false to the following statements:

- True Enzymes interact with specific substrates
- False Enzymes change shape after a reaction occurs
- True Enzymes speed up reactions.
- False One enzyme can be used for many different types of chemical reactions.
- True Enzyme reactions can be slowed or halted using inhibitors.

3. Circle the correct effect.

- Raising the temperature slightly will increase | decrease | not change | the rate of reaction
- Boiling temperature will [increase | decrease | not change] the rate of reaction.
- Changing the pH toward the optimal pH will increase | decrease | not change | the rate of reaction.
- Introducing a competitive inhibitor will [increase | decrease | not change] the rate of reaction.

4. Place a check mark next to the things that are expected to INCREASE the rate of an enzymatic reaction(at least for a while)

- ✓ Add more enzyme
- Add more substrate molecules
- ✓ Adjust pH to optimal level for the enzyme
- Add a non competitive inhibitor
- Freezing/cold temperatures

Enzyme Worksheet

After reading the information on enzymes answer the following questions:

1. What does a catalyst do? increases rate of reaction without
using up the enzyme
2. What is an enzyme? a protein that aids in metabolism to
increase chemical reaction rate
3. Why do enzymes generally bind to only one type of substrate? they are specific
4. How are the "lock and key" and "induced fit" models similar? both imply that
the substrate must match the enzyme's
shape to work
5. How are the "lock and key" and "induced fit" models different? induced fit indicates
the enzyme changes shape slightly after rxn; not
so in lock & key
6. What are 3 things that can affect the way enzymes work? Explain how each thing would affect an enzyme.
 - a. temp
↑ or ↓ temp slows & stops reactions
 - b. pH
↑ or ↓ pH to non-optimal pH slows/stops rxn.
 - c. salt concentration
- ↓ reaction rate - non competitive
inhibitor

Enzyme molecules are affected by changes in conditions within organisms.

Explain how a prolonged, excessively high body temperature during an illness could be fatal to humans. Your answer must include:

- the role of enzymes in a human [1]
- the effect of this high body temperature on enzyme activity [1]
- the reason this high body temperature can result in death [1]

Enzymes control chemical reactions in our body.

High temperatures in the body can make the enzyme change shape or denature causing the substrate to not "fit" into the active site.

Death can occur if the enzymes no longer run the chem. reactions needed for life

