



General Biology 1
2nd Quarterly Period



WORKSHEET NO. 4: ENZYMES ACTIVITY

NAME:
STRAND, GRADE & SECTION:

DATE ACCOMPLISHED:
TEACHER:

Activity 1: How Enzymes Work

HOW ENZYMES WORK	
In the diagrams below do the following:	Key Ideas
1) Label the active site of the enzyme 2) Label and colour the enzyme blue 3) Label and colour the substrate red 4) Label and colour the product green	Words to use complex low product biological thousands active site complementary activation unchanged specific catalyse substrate
<p>①</p>	Enzymes are known as _____ catalysts. The enzyme has an _____ which the substrate molecule is able to fit into. The substrate molecule is said to have a _____ shape to the enzyme's active site. Enzymes are said to be _____ to just one _____ for this reason.
<p>②</p>	When the substrate and enzyme molecules temporarily combine it is known as an enzyme-substrate _____. As the enzyme holds the substrate molecule in a certain way it puts tension on the substrate molecule. This lowers the _____ energy needed for the reaction to take place. This is why reactions can occur at relatively _____ temperatures in living things.
<p>③</p>	During the reaction the substrate is turned into _____. This is released from the enzyme's active site and the enzyme molecule is left _____ and free to _____ more reactions. Each reaction in our body involves a specific enzyme. We have _____ of different enzymes in our body.

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Activity 2: Enzyme Cut-outs Activity

Objectives

Enzymes are proteins that help chemical reactions occur at a faster rate by lowering the energy needed for the reactions. First, the enzymes react with a **substrate** to form an **enzyme-substrate complex** (like a lock and key). Once this complex is formed, the substrate becomes a **product** or **products** and **leaves the enzyme**. The enzyme can then repeat the reaction with more substrate. The enzyme is shaped so it will react with only one specific substrate. On the next page are shapes of enzymes, substrates, and products. Your job will be to cut them out, manipulate them, glue them, and explain the reaction that occurs. Complete Parts A, B, and C.

Materials

class notes
construction paper

glue
cut-out sheet

scissors
pen or pencil, coloring materials

Part A: VOCABULARY

Define the following terms (Hint: You can use your notes, study guide, book, or ppt provided.).

1. enzyme –
2. catalyst –
3. chemical reaction –
4. activation energy –
5. substrate –
6. active site –
7. denatured –

THEN: Color the diagrams (cut-outs) according to the following:

Enzymes – PINK

Triangular Substrate – PURPLE

Product 1 – BLUE

Product 2 – RED

Square Substrate 1 – YELLOW

Square Substrate – BLUE

Rectangular Product - GREEN

Part B: HYDROLYSIS

1. Using the enzyme cut-out stock paper, cut-out all of the triangular shaped enzymes, substrates, and products.
2. Organize the cut-outs on the construction paper (any color) so the pieces demonstrate this equation:
enzyme + substrate → enzyme-substrate complex → enzyme + product 1 + product 2
3. Glue the cut outs in the appropriate places on the construction paper. Color the enzyme blue, substrate red, and product green.
4. Label the cutouts that you glued as the following compounds:
Enzyme = lactase
Substrate = lactose
Products = glucose and galactose
5. With the above terms and equation, explain what happened (write your explanation on the same side of construction paper). Use as many vocabulary words from Part A as you can.

Part C: DEHYDRATION SYNTHESIS

1. Using the enzyme cut-out stock paper, cut out all of the square / rectangular shaped enzymes, substrates, and products.
2. Follow the directions as above, this time demonstrating this equation:
Enzyme + substrate 1 + substrate 2 → enzyme-substrate complex → enzyme + product
3. As with the previous sheet, glue and label the cutouts as the following compounds:
Enzyme = Sucrase
Substrates = glucose and fructose
Product = sucrose
4. With the above terms and equation, explain what happened (write your explanation on the same side of construction paper). Use as many vocabulary words from Part A as you can.

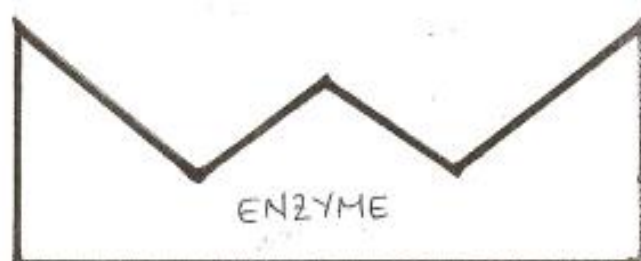
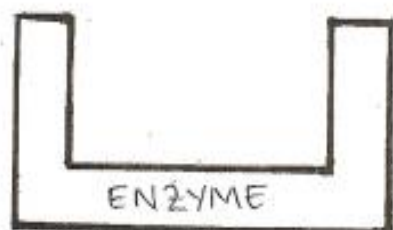
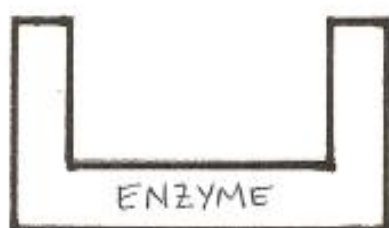
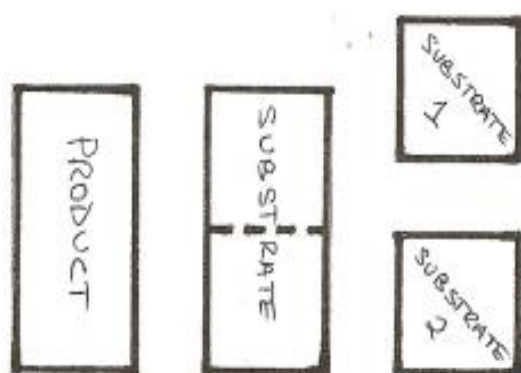
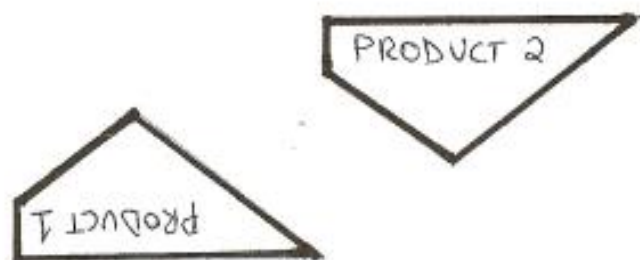
Note: The cut-out stock paper of enzymes, substrates, and products are provided at the next page.

Analysis

1. What did you discover about chemical reactions while doing the activity?

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Activity 3: The Effect of PH on Enzyme Activity

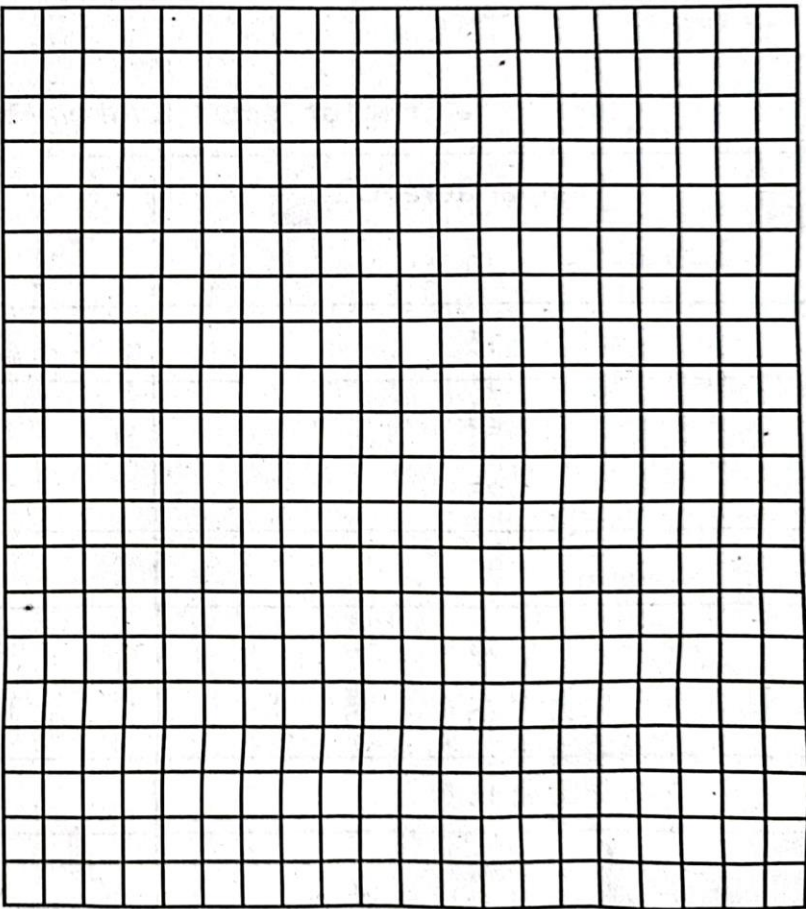
Each enzyme works best at a certain temperature and pH. Below or above an enzyme’s optimal temperature or optimal pH, the reaction is slower.

1. Using the data in the chart, plot a graph showing the rate of enzyme action for the enzymes Pepsin and Trypsin at different varying pH.

Analysis

2. What is the rate of enzyme action for the enzymes Pepsin and Trypsin at different varying pH.

pH	Rate of Enzyme Action (for Pepsin)	Rate of Enzyme Action (for Trypsin)
1	1	0
2	3	0
3	7	0
4	3	0
5	1	1
6	0	3
7	0	7
8	0	9
9	0	7
10	0	3
11	0	1
12	0	0
13	0	0
14	0	0



3. Considering the range of pH that is most effective, where in the body might Pepsin be found?

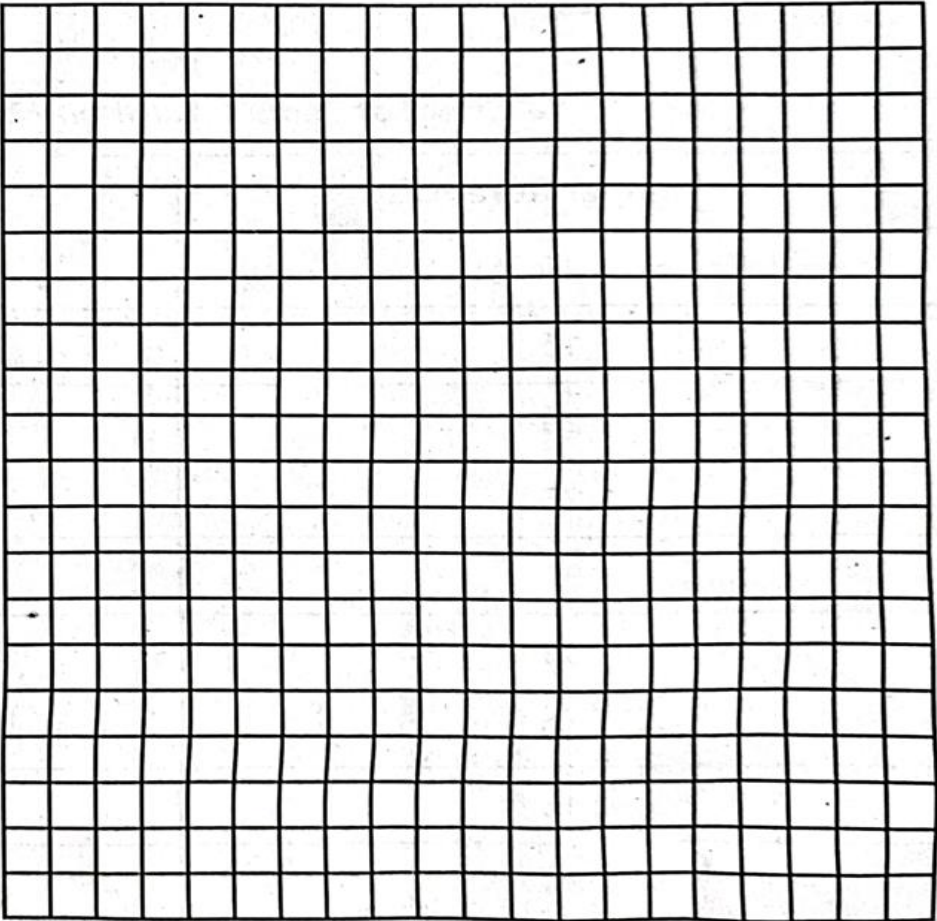
4. At what pH is Trypsin most effective?

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Activity 4: The Effect of Temperature on Enzyme Activity

1. Using the table and grid below, graph the data to determine the optimum temperature for the **enzyme catalase** which speeds up the following reaction:
H2O2 → H2O + O2 (Hydrogen Peroxide → Water + Oxygen)
2. Describe the line that you just drew; what happens as temperature increases?
3. What is the optimum temperature for which the enzyme activity is the greatest for this reaction?

Temp (°C)	Reaction Rate (mol/min)
5	0
10	5
20	15
25	20
30	22.5
35	25
40	22.5
42.5	15
45	0
50	0
55	0
60	0



4. What happens to an enzyme at optimal temperature?
5. What happens to an enzyme when the temperature is too low?
6. What happens to an enzyme when the temperature is too high?
7. Temperature is also an important influence on enzyme action. At what temperature do most human enzymes work best and why?

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Enzymes Activity – Grading Rubric

Criteria	Excellent (10 points)	Good (7 points)	Fair (4 points)	Needs Improvement (3 points)	Rating
Accuracy of the Content	Scientific facts and quality of information are exceptional.	Scientific facts and quality of information are good.	Scientific facts and quality of information are present but limited.	Scientific facts and quality of information are inaccurate and irrelevant to the subject matter.	
Neatness & Organization	Task is done in a very neat and highly-organized manner that makes it easy to read and understand.	Task is done in a neat and quite organized manner that makes it easy to read and understand.	Some parts of the task are done in a neat and organized manner that makes it easy to read and understand.	All or most of the parts of the task are messy and are illogically arranged.	
Writing & Grammar	Grammar, punctuation, capitalization, and sentence structure are always correct and enhance the writing clarity and style.	Grammar, punctuation, capitalization, and sentence structure is good, but does not always add to the style of writing.	Problems with grammar and usage are not serious enough to distort the meaning, but may not be correct or accurately applied all the time.	Errors in grammar and usage are very noticeable, frequent, and affect meaning.	
Completeness & Timeliness (Work Ethics)	All needed parts are given with appropriate information. Task is done and submitted on time.	Most needed parts are given with appropriate information. Task is done and submitted a bit to two days late.	Most needed parts are given but with some inappropriate or little information. Task is done three to five days late.	Some needed parts are given but with limited appropriate information. Task is incompletely done. Submitted more than five days late.	