

# Toothpickase Enzyme Lesson Plan

<b>Grade Level:</b>	9 <sup>th</sup> grade	<b>Subject:</b>	PreAP Biology	<b>Prepared by:</b>	Jessica Svoboda, Modified from Jennifer Giannou
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Objective	Warm Up	Reminders	Key Concepts
Identify and investigate the role of enzymes.	Do the following for Proteins and Nucleic Acids <ul style="list-style-type: none"> <li>List the elements</li> <li>Describe the Functions</li> <li>Provide Examples</li> </ul>	Test Corrections for Exam 2 must be completed by TODAY  Exam NEXT CLASS  Project Due 11/1	Understand the roles of enzymes in general and in the body Correlate knowledge about biomolecules to understand the functions of enzymes Role-play the functions of enzymes through a lab Analyze how the lab correlates with enzyme kinetics

B.9.C. identify and investigate the role of enzymes. Supporting Standard

## Materials:

150 toothpicks for each group

3 dixie cups per group/marked for each round/50 toothpicks in cups A and B

One small plate for each table

Class sets of instructions, one per student

Toothpickase Student handout

Visual instructions for students

Waste basket

Activities: **Independent Practice** – **Modeling** – **Group Practice** – **Check for Understanding**

(5 min – before bell)

Students have their binders out and are writing down the objective and warm up for the day.

(3 min)

Students are writing down their objective and warm up and turning in their homework from the day before.

(20 min): Pass out Enzyme note sheet

“Today we will be continuing our notes on biomolecules, focusing specifically on a specific kind of proteins: enzymes. Please open your iPads and log into joinme so you can see my screen.” Wait for everyone to get their iPads. “What are some things you already know about enzymes?” **Check for understanding** (Students should be able to respond, direct their answers towards carbs we find in foods if nobody responds). Go through the notes with the students, explaining important features BEFORE they start writing. Interject with examples and comparisons **Group practice**

Instructions and Modeling (10 min): Pass out class set, waste baskets and Cup C

“We will now apply what we just learned about enzymes in an interactive lab! As you can see on the toothpickase lab sheet, each person at your table will have a specific role in determining the efficiency of a particular enzyme. At this time, I will give you five minutes to read through the lab yourself before we go over it together.” (Make sure the students are actually reading their lab procedures). **Check for understanding** after the students read through the instructions

“I need two volunteers to help me with the lab. I need volunteers who are familiar with the procedures to help me present the lab visually to the rest of the class. In part A, it says we are catalyzing the reactants and products four times on the same plate. Please pay close attention as we will not be repeating the procedures.” (Tell the first student to keep track of time in intervals of 10, 20 30 and 60 seconds. Tell the second student to count how many toothpicks I break on the plate). **Modeling** “The first round requires the enzyme to break apart as many toothpicks as I can in ten seconds. I can’t look at the plate at all during this time and I have to use my non dominant hand, which is my left hand.” **Guided practice** (Go through the first and second round to demonstrate the lab procedures for all three parts). “You will repeat these steps for the second part but you will break the toothpicks on the table instead of the plate. In the third round, you perform the same procedures except two students will break toothpicks instead of one.” **Modeling** (Thank the student volunteers and wait for them to return to their seats).

“In the first round, you will place all broken toothpicks in the trash bin and all unbroken toothpicks in the cup marked “Cup C.” When you have completed Part A, raise your hand and I will bring you your toothpicks for Part B. After completing part B, put all unbroken toothpicks in the cup marked “Cup C” and any broken toothpicks in the trash bin. Before receiving your toothpicks for part C, you will count the toothpicks in your “Cup C” and report them to Ms. Svoboda. At that time, I will bring you the necessary toothpicks you will need to complete Part C. When you are finished with the lab, make sure you answer all the questions on the back of the sheet in complete sentences.”

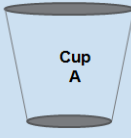

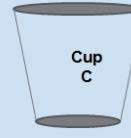
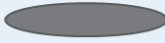
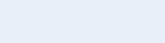
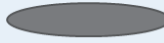
Go over the expectations (CHAMPS) for the enzyme lab as well as the tips for the lab. Then present a visual of the instructions for each round. **Modeling** Finally, assign roles to the students by numbering them off from 1-4 and then using the spinner to see which role will correlate to which number.

- C – Talking should remain on task to complete the lab
- H – I will help restore your substrate, raise your hand
- A – Toothpickase lab
- M – Stay in your seat
- P – active, group
- S – Follow the directions and stay on task. THIS IS NOT A RACE

**DAILY EXPECTATIONS**

1. Do not look at the plate when breaking the toothpicks
2. Only use your NON-DOMINANT hand
3. Leave the broken toothpicks on the plate as you move through all timed steps in part A
4. Put the broken toothpicks in the waste basket after each part (A,B,C), not individual timed steps
5. Put the non broken toothpicks in cup C after parts A and B
6. THIS IS NOT A RACE, KEEP A CONSTANT PACE

**TIPS FOR THE TOOTHPICKASE**

PartA	PartB	PartC
Cup A toothpicks broken on plate 	Cup B toothpicks spread out on table and broken 	Cup C toothpicks broken on plate 
 <ul style="list-style-type: none"> <li>•Break toothpicks on the plate only</li> <li>•Keep broken and unbroken toothpicks on the plate until the entire Part A is finished</li> <li>•Dispose of toothpicks properly</li> </ul>	 <ul style="list-style-type: none"> <li>•Break toothpicks on the table directly</li> <li>•Keep broken toothpicks on the table until the part B is completely over</li> <li>•Put broken toothpicks in the waste basket</li> <li>•Put intact toothpicks in Cup</li> </ul>	 <ul style="list-style-type: none"> <li>•2 people now break toothpicks on the plate only</li> <li>•Keep broken and unbroken toothpicks on the plate</li> <li>•Put broken toothpicks in the waste basket</li> <li>•Put intact toothpicks back in Cup</li> </ul>

The repetitive nature of the instructions may make students anxious. However, remind them that they need to properly complete the lab and so the instructions will need to be explicit and clear to diffuse any confusion.

Enzyme Lab (35 min): Pass out Cup A and Plates **Independent Practice**

Students will work through the lab procedures for the entirety of the time given. Teacher monitors the lab to make sure students are following directions. (S)he is also responsible for passing out more toothpick cups and restoring the amount of toothpicks necessary for each round. If students finish the lab early, they may work on their test review.

Guiding Critical Thinking:

Students are asked to replicate the enzymatic activity of a specific enzyme (toothpickase) and its substrate (the toothpicks) The analytical questions help relate the information about enzymes to the lab performed during class. For example, the students know that certain factors such as temperature, pH and substrate concentration affect the efficiency of enzymatic activity. A question asked in the analysis is “what would happen if the enzyme were placed in ice?” This requires the students to not only apply

the information they know about enzymes but it can be inferred that since the hand was the enzyme in this example, the “enzyme” would slow down.

Differentiation:

Learning Style	Accommodations
Students get the visual from the notes and instructions	Students have the iPads for note taking if they cannot see the board
Students get the verbal from reading the notes aloud and conversations with shoulder partners	Students are grouped to enforce scaffolding between classmates
Students get the kinesthetic from lab manipulatives	

Assessment:

Students will turn in their models and worksheets.

Reflection:

The main idea we wanted the students to understand was that each enzyme has one specific substrate. While the lab was a great hands-on activity for this concept, the main idea was somehow lost in the process. This was evident during the assessment when students were asked what would happen if the enzyme were introduced to plastic toothpicks. Many students hypothesized that the toothpickase enzyme would slow down and the rate of reaction would slow as well. We wanted the students to bring up that the enzyme would not be able to function with this different substrate and that the reaction would cease. In the future, the last round could incorporate plastic toothpicks with the wooden toothpicks. Students would be asked to completely avoid the plastic toothpicks or else their enzyme would be discarded.

The roles of the game were meant to provide consistent structure to the activity and help with time constraints. However, many of the students were reluctant to carry out their role since they were never able to physically break the toothpicks like the toothpickase role. I originally believed that switching up the roles would give each student the ability to perform the functions of the enzyme. However, I then realized the assessment and entire lab revolved around the consistency of one enzyme performing multiple tasks. If the role were to switch to a new student each round, there would be no point in recording the rate in which the enzyme carried out the reaction. It would automatically differ for each student and would never coalesce in terms of data.

The set up for the materials was exhausting for me. I attempted to conserve toothpicks and organize the methods for toothpick access all in one method. This method was not a failure but was exhausting. I put each round of 50 toothpicks in the cups labeled A, B, and C. When one group was finished with one round, they would count their remaining intact toothpicks and place them in an

unmarked cup for collection. I would then switch their intact toothpicks for a cup of 50 more toothpicks for their next round. This meant I was up and around the room with the main purpose to restock toothpicks. This took my attention away from the progress of the game and the attentiveness of the students. Next time, I will give each group two cups: one to receive toothpicks and one to give back toothpicks. The students will have to come up to the prep table and retrieve their own toothpicks for the next round. The cup used to give back toothpicks will be filled with intact toothpicks after each round and return to the prep table at the end of the lab. This gives the students a more active role and allows me to focus my attention on the progress of the lab.