

# Speedy Cat

## Enzymes

K20 Center, Christen Rowland
Published by *K20 Center*

*This work is licensed under a Creative Commons CC BY-SA 4.0 License*

| | | | |
|---|---|---|---|
| **Grade Level** | 9th – 12th Grade | **Time Frame** | 2-3 class period(s) |
| **Subject** | Science | **Duration** | 150 minutes |
| **Course** | Biology | | |

## Essential Question

How do enzymes change the reactions in which they participate?

## Summary

In this lesson, students will explore the dynamics of enzymes by investigating what enzymes do, how they work, and in what types of substances they are found. Prior this lesson, students should have developed a good understanding of cell structure, function, and membrane transport.

## Snapshot

### Engage

Students watch a demonstration of pudding being digested and complete a quickwrite to explain what they think happened.

### Explore

Students complete the activity in the attached "Need for Speed: A Look at Enzyme Activity" handout. In groups, students will act as enzymes to discover their specific characteristics.

### Explain

Students participate in an I Think/We Think activity to reflect on the the work done for the "Need for Speed: A Look at Enzyme Activity" handout.

### Extend

Students participate in the "Gelatin Enzyme Lab," investigating different food substances, identifying which of those foods have enzymes, and determining the enzymes' purposes.

### Evaluate

Students summarize their knowledge on enzymes in a song, rap or chant.

## Standards

*ACT College and Career Readiness Standards - Science (6-12)*

**IOD304:** Determine how the values of variables change as the value of another variable changes in a simple data presentation
**SIN301:** Understand the methods used in a simple experiment
**EMI401:** Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

*Oklahoma Academic Standards (Physics)*

**B.LS1.1:** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.

*Oklahoma Academic Standards (Physics)*

**PH.PS4.5 :** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*

## Attachments

- Gelatin Enzyme Lab - Spanish.docx
- Gelatin Enzyme Lab - Spanish.pdf
- Gelatin Enzyme Lab.docx
- Gelatin Enzyme Lab.pdf
- NEED FOR SPEED ANALYSIS - Spanish.docx
- NEED FOR SPEED ANALYSIS - Spanish.pdf
- NEED FOR SPEED ANALYSIS.docx
- NEED FOR SPEED ANALYSIS.pdf
- Need for Speed A Look at Enzyme Activity - Spanish.docx
- Need for Speed A Look at Enzyme Activity - Spanish.pdf
- Need for Speed A Look at Enzyme Activity.docx
- Need for Speed A Look at Enzyme Activity.pdf
- T-Chart for I Think, We Think - Spanish.docx
- T-Chart for I Think, We Think - Spanish.pdf
- T-Chart for I Think, We Think.docx
- T-Chart for I Think, We Think.pdf

## Materials

- Chocolate pudding
- Digestive enzyme capsules
- Marbles
- Tape
- 500 pennies
- Gelatin
- Beaker
- Test tubes
- Test tube rack
- Pipettes
- Stirring rod (or coffee stirs)
- Graduate cylinder
- Boiling water
- Cold water
- Adolph's Tenderizer
- French's Meat Tenderizer

- Fruit juices/pulp

# Engage

The teacher should set up the demonstration by making ready two chocolate pudding containers and a digestive enzyme capsule. Digestive enzyme capsules can be easily found at a grocery store or pharmacy. With students observing, the teacher should open one enzyme capsule and mix it into one of the pudding cups, leaving the other pudding cup unaltered. After three-and-a-half minutes, the teacher should show students what has happened to the pudding containing the enzymes and compare it to the pudding cup in which there are no enzymes. At this time, students will complete a quick write on what they think is going on in the pudding. A YouTube example of the demonstration can be found at "Watch Digestive Enzymes Break Down Chocolate Pudding" (hyperlink). After the demonstration, in groups of two or three, students will discuss their explanations and things they think were going on in the pudding. One spokesperson from each group will then share the results of the discussion with the whole class.

**Teacher's Note**

As the spokespersons are presenting, it might be an appropriate time to introduce the definitions of the terms "enzyme" and "catalyst."

An enzyme is a biological catalyst that helps accelerate or catalyze a chemical reaction.

A catalyst is a substance that speeds up the rate of a reaction without being consumed.

# Explore

Students will participate in the investigation described in the attached "Need for Speed: A Look at Enzyme Activity." Before the activity begins, the students will copy the data table to use for recording their information. Divide students into groups of two or three. Trial one will be done as a whole group. Each group will nominate a person to represent an enzyme. Students will work to pick up pennies and return them to their assigned lab tables as quickly as possible. In trial two, the student who is the "enzyme" will have two fingers taped together. For trial three, the individual who is the "enzyme" must work with a marble taped to the fingers. In these activities, students are to act as if their hands are the enzymes. When the fingers are taped together, it represents what happens during denaturation of an enzyme. When a marble is taped to the fingers, it represents the activity of inhibitors.

**Teacher's Note**

This might be the most appropriate time to explain that enzymes have a lock and key fit (one type of enzyme for a specific substrate), or a glove and hand fit.

# Explain

Students will participate in an I Think/We Think discussion/reflection over the "Need for Speed: A Look at Enzyme Activity" lab. The teacher should either pass out the attached "T Chart for I Think/We Think" handout, or have students construct a two-column table in their notes. Students will then answer the questions in the attached "Need for Speed Analysis." The teacher should provide time for students to record their thoughts about each question in the "I Think" column. Students will then work in groups of two or three (different from the lab groups) to discuss and write answers in the "We Think" column. Groups will pick a spokesperson and then the teacher should randomly pick different groups to answer each question.

# Extend

Students will participate in the investigation described in the attached "Gelatin Enzyme Lab." This lab will take two days to complete because the materials need to sit overnight. Students will be adding various substances to gelatin to see if different common foods and spices contain enzymes and how those enzymes work. When finished, students will reflect on the lab by answering questions about variables and controls and the role of enzymes.

# Evaluate

At the end of the lesson, students will work in pairs using the Chant It, Sing It, Rap It activity to create a performance about enzymes. The teacher should be sure students include how enzymes work, things that may interfere with enzymes, and real examples from their work on the attached "Gelatin Enzyme Lab." Students will then be asked to share their chants, raps or songs with the class.

**Teacher's Note**

To differentiate, the teacher could also allow students to write poems or use some other creative device that could be shared.

## Resources


- Crossroads. (2015, February 19). "Watch digestive enzymes break down chocolate pudding." [Video file]. Retrieved from https://www.youtube.com/watch?v=hB5fBoegUiQ
- I Think/We Think: Instructional Strategy: K20 Center. (n.d.). Copyright 2015, Board of Regents of the University of Oklahoma. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5065bfd
- Chant It, Sing It, Rap It Instructional Strategy: K20 Center. (n.d.). Copyright 2015, Board of Regents of the University of Oklahoma. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5066ebf
- Massengale's Biology Junction. (n.d.) "Enzyme lab one: What form of pineapple juice contains enzymes that digest protein?" Retrieved from www.biologyjunction.com/10sPineappleEnzymeLab.doc