LESSON PLAN 1

MODULE TOPIC: (Digestive System) The digestive system takes the foods we eat and breaks them into smaller components with the help of enzymes.

STANDARD(S) & INDICATOR(S):
HS- LS1- 3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. (HS-LS1-3)

OBJECTIVE(S): SWBAT:
1. Describe the function of enzymes in the digestive system in a paragraph.
2. Create a drawing and a written explanation of what happens to an enzyme when it is not at the right pH or temperature.
3. Analyze what will happen to pepsin if it is moved to the small intestine using data.

MATERIALS: Digestion system diagrams, construction paper, markers, textbook, and laptops

LIST OF HANDOUTS (attach original copies of each handout - teacher & student edition)
Students will read essay "What happens to the food you eat" pg 334-336 and essay "energy is converted and conserved" 354-356 in their classroom text book **Biology: A Human Approach**.

BACKGROUND INFORMATION:
The digestive system will be explained by emphasizing the role of enzymes in digestion. Enzymes are proteins that speed up chemical. Digestive enzymes are responsible for breaking down specific substrates. Enzymes only work at a specific temperature and pH ranges. If an enzyme is not at the right temperature or pH it will cause the active site to denature and stop working.

CLASSROOM ACTIVITY DESCRIPTION (LABORATORY/EXERCISES/PROBLEMS) including detailed procedures:
Students will first list what organs they believe are involved in the digestive system, then students will check to see how many they got correct. Students will then read two essays in their textbook, one on the digestive system and the other on enzymes and pH. Students will draw what would happen to a stomach enzyme if it were placed in the small intestine. Students will then explain their drawing in a paragraph. They will then solve a practice problem involving enzymes.

SAMPLE QUESTIONS TO ELICIT CLASS DISCUSSION:
Which organs are involved in digestion?
How does our body break down the food we eat so that we can provide our body with nutrients, energy, vitamins, etc?
What aids substances aids organs in digestion?
What are enzymes?

HOMEWORK ACTIVITY/EXERCISES/PROBLEMS:

1. Describe the function of enzymes in the digestive system in a paragraph.
2. Create a drawing and a written explanation of what happens to an enzyme when it is not at the right pH or temperature.
3. The table below lists enzymes that function in different locations in the human body, and the normal pH and temperature ranges of these locations.

ENZYMES IN THE HUMAN BODY

Location of enzyme	Enzyme	pH ranges of location	Temperature (°C) ranges of location
Mouth	Salivary amylase	6.0 - 7.0	36.7 - 37.0
Stomach	Pepsin	2.0 - 3.0	37.3 - 37.6
Small intestine	pancreatic amylase, trypsin, lipase	7.5 - 9.0	37.3 - 37.6

Use your understanding of the structure and function of enzymes to

a. Predict how the activity of pepsin will change after it moves from the stomach to the small intestine.
b. Explain your prediction using data from the table.
c. Describe how changes in pH and temperature affect enzyme activity.
d. Predict how a fever of 40°C would affect enzyme activity .

PARAMETERS TO EVALUATE STUDENT WORK PRODUCTS:

Accuracy of the description of the function of enzymes in the digestive system.
Accuracy of explanation of what happens to an enzyme when it is not at the right pH or temperature.
Accuracy of analysis what will happen to pepsin if it is moved to the small intestine using data.

REFERENCES:

http://www.woodbridge.k12.nj.us/cms/lib010/NJ01913008/Centricity/Domain/1655/BIOLOGY_END_OF_COURSE_STUDY_GUIDE.pdfLESSON PLAN TEMPLATE

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Writing Rubric

Points	Criteria
4	A 4-point response clearly demonstrates understanding of the task, completes all requirements, and provides an insightful explanation/opinion that links to or extends aspects of the text.
3	A 3-point response demonstrates an understanding of the task, completes all requirements, and provides some explanation/opinion using situations or ideas from the text as support.
2	A 2-point response may address all of the requirements, but demonstrates a partial understanding of the task, and uses text incorrectly or with limited success resulting in an inconsistent or flawed explanation.
1	A I-point response demonstrates minimal understanding of the task, does not complete the requirements, and provides only a vague reference to or no use of the text.
0	A 0-point response is irrelevant or off-topic.

***Requirements for these items will vary according to the task**.

Adapted from

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LESSON PLAN 2

MODULE TOPIC: (Drug delivery) Students reinforce their knowledge of the different parts of the digestive system and explore the concept of simulation by developing a pill coating that can withstand the mixing actions and acidic environment found in the stomach.

STANDARD(S) & INDICATOR(S):
HS- LS1- 3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. (HS-LS1-3)

OBJECTIVE (S): SWBAT-

1. Create a recipe for their coated candy that can withstand stomach digestion (soda).
2. Create a table to record quantitative and qualitative data of their coated candy placed in an environment that simulates the environment found in our stomachs.
3. Describe why their coated candy was able or not able to withstand stomach digestion based on their data and background research of each ingredient.
4. Create a new recipe that they believe will be more successful based on their experiment.

MATERIALS:
· 60 mL (¼ cup) flour
· 30 mL (1/8 cup) corn starch
· 60 mL (¼ cup) sugar
· 30 mL (1/8 cup) vegetable oil
· 1 paper plate
· 4 small paper or plastic bowls or cups
· 1 clear plastic cup
· 1 cup clear diet (to avoid stickiness) soda
· 1 small plastic spoon
· 2 pieces of (skittles) color-coated candy per group
· Recipe and Fraction worksheet (one per person)
For the entire class to share:
- marker, to write team names on plastic cups
- 1 cup clear diet soda in a plastic cup (for experiment control)
- timer

LIST OF HANDOUTS (attach original copies of each handout - teacher & student edition)
Fraction worksheet
Writing Rubric

BACKGROUND INFORMATION:
Many medicines help our bodies fight sicknesses and diseases, but can also make our stomachs hurt. To prevent this stomach pain while still allowing the medication to get into our bodies, engineers and pharmacists have developed pill coatings that do not dissolve until after they have passed through our stomachs. These specially-coated pills are called "enteric-coated" pills or tablets.

CLASSROOM ACTIVITY DESCRIPTION (LABORATORY/EXERCISES/PROBLEMS) including detailed procedures:

Students will act as engineers and develop their own "enteric" coating. They will create a recipe for our coating, and then test it by observing its effectiveness in protecting a piece of candy placed in an environment that simulates the environment found in our stomachs. Then, just like engineers, they will analyze their qualitative and quantitative data and make suggestions for improvements to their design.

SAMPLE QUESTIONS TO ELICIT CLASS DISCUSSION:

1. Which foods or medications make their stomachs hurt?
2. Why is it better to test the pill in a simulated environment rather than testing it on a human?
3. Which coated candy worked the best in this class?
4. How will we obtain quantitative data for this experiment?

HOMEWORK ACTIVITY/EXERCISES/PROBLEMS:

1. Complete Recipe Worksheet
2. Create a table to record quantitative and qualitative data of your coated candy once it was placed in soda.
3. In two paragraphs explain why your coated candy was able or not able to withstand stomach digestion based on your data and background research of each ingredient. Include a new recipe that you think would be more successful.

PARAMETERS TO EVALUATE STUDENT WORK PRODUCTS:

Accuracy of calculations for their fraction worksheet.
Accuracy of table created for qualitative and quantitative data and placed each variable correctly.
Writing rubric
Explanation for new recipe.

REFERENCES:https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_biomed/cub_biomed_lesson05_activity1.xml

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Recipe and Fraction Worksheet

Recipe #1		
	Number of Spoonfuls	Fraction
oil		
sugar		
flour		
corn starch		
Total		

Recipe #2		
	Number of Spoonfuls	Fraction
oil		
sugar		
flour		
corn starch		
Total		

$$\text{Fraction} = \frac{\text{Number of spoonfuls of ingredient}}{\text{Total number of spoonfuls}}$$