Individual Learning Modules

Course: Biology I **April 6th – April 10th**

Main Idea/Focus: Communicating Information Making a Better Bread – Mastering Fermentation	**Aligned resource (Pearson *Biology*)** 10.3 Cellular Respiration (pg. 330)

Standard(s):
How does this align with your state standards?

BIO1.LS1.9 – Compare aerobic respiration to alternative processes of glucose metabolism.

Resource(s):
What do you need? Text, data sets, tools, etc.

Textbook: Miller & Levine, *Biology* – access through Clever
In addition to the textbook, the following links may prove useful or of interest:

- https://www.ifst.org/lovefoodlovescience/resources/raising-agents-biological-fermentation
- https://www.youtube.com/watch?v=3UjUWfwWAC4

Task(s):
What will you do? What will you investigate?

Professional bakers and cooks often try to develop new recipes for their favorite foods or dishes. Amateurs enjoy this process, too. For example, when following a recipe for bread, an enterprising baker might change the amount of sugar or salt, add new ingredients like raisins or sesame seeds, or change the timing of different steps. In many ways, developing a new recipe is an example of the engineering process in action. Engineers often try a variety of plans and ideas to develop a working model, or prototype, of their invention or process. Then, when they have settled on the prototype, they produce it full size or in large amounts.

Read the recipe for sourdough bread shown here, and then answer the questions:

Ingredients: 4 cups bread flour, 3 tablespoons sugar, 2 tablespoons salt, ¼ ounce dry yeast, 1 cup warm milk, 2tablespoons margarine, 1 ½ cups sourdough starter

Steps:

1. In a large bowl, combine 1 cup flour and the sugar, salt, and dry yeast. Add milk and margarine. Stir in starter. Gradually mix in 3 cups of flour.
2. Turn dough out onto a floured surface and knead for 8 to 10 minutes. Place in a greased bowl, turn once to oil surface, and cover. Let the dough rise at room temperature for 1 hour or until doubled in volume.
3. Punch down, and let rest for 15 minutes. Shape into 2 or 3 small loaves. Place on a greased baking pan. Allow to rise for 1 hour or until doubled.
4. Bake at 375^{o} F (190^{o} C) for 30 minutes.

Final Product(s):
What will you answer? What will you create? What will you communicate?

1. Construct an Explanation – How is fermentation important in the baking of sourdough bread? During which step does fermentation occur? To construct your answer, apply your knowledge of fermentation and scientific reasoning.

2. Conduct Research – A sourdough starter is essential to making sourdough bread. Research how to make and maintain your own sourdough starter.
3. Predict – Consider the following changes to the recipe. Predict the result of each change, and explain you reasoning. Assume that each change occurs individually, without enacting any of the other changes:
    a. Step 2 is eliminated.
    b. Before step 3, the dough is rolled into very thin sheets
    c. In step 3, the dough rises for only 30 minutes.
    d. In step 2, the dough rises inside a refrigerator.
4. Conduct Research – Bakers might follow many recipes or procedures for baking bread or related products. Select a recipe from a cookbook or the internet, and research how it relies on fermentation.
5. Communicate Information – Write a brief report to share your research findings and conclusions. Be sure to address the following points:
    a. Describe the steps that are followed to produce the food. Explain how fermentation is used.
    b. Which organisms are used to perform the fermentation process? Why are these organisms useful for the food?
    c. How does the food-making process compare with the processes used for other foods that depend on fermentation?

Lab at Home! *What will you investigate? What will you explore?*	**Aligned resource (Pearson *Biology*)**
Rise Up – You will compare bottle-and-balloon experiments to determine what factors affect cellular respiration in yeast. **Safety:** Safety googles or protective eyewear	10.3 Fermentation (Page 323)

Resource(s):
What do you need? At home tools, lab set-up, etc.

- Balloons (3)
- Bottles of the same size (3) – preferably plastic, for safety reasons
- 1 packet of yeast
- Warm water
- Sugar
- Measuring tools (measuring cup, tablespoon)

Procedure:
What are the steps in the process?

1. Obtain three balloons and three plastic bottles. Stretch the balloons by pulling on them and them up once or twice. Label the bottles #1, #2, and #3. Fill each plastic bottle about half full with very warm water.
2. To each bottle, add the following, and the gently swirl to dissolve the contents.
    - Bottle #1: one packet of yeast
    - Bottle #2: 4 Tablespoons (TBSP) of sugar
    - Bottle #3: one packet of yeast and 2 Tablespoons of sugar
3. Record your observations, and then carefully stretch a balloon over the mouth of each bottle.
4. Every 5 minutes for 30 minutes, use string to measure the widest circumference of the balloon. Record your measurements. How else could you take measurements? Record any measurement, qualitative or quantitative, necessary for proper analysis and conclusion.

Analysis and Conclusion:
What are the results? How are these results relevant?

1. Communicate Information – How did the results for the three bottles differ?
2. Draw Conclusions – What caused this difference? Explain.
3. Design an Experiment – Write a procedure for testing another factor that could affect the rate of fermentation of yeast.