Strand **8.3**	Standard **8.3.2**	Episode 4	**Big Idea:** All living things need food to get energy.

Title: It's in the Bonds	**Time**: 90 - 135 minutes	CCCs: Matter and Energy Cause and Effect	Practices: **Planning and Carrying out Investigations** **Obtaining, evaluating, and communicating information**

Episode Snapshot: Students explore the use of sugar as a food source for yeast. They identify a gas produced (CO_2) during the process.

Gathering

Working in groups of 3 or 4 students *explore* the phenomenon by **carrying out an investigation** of culturing yeast. The students will **obtain information** through observation about what matter the yeast needs to obtain the energy to grow and what products are produced during the growth process. The gas that is produced will be captured and students will make predictions, within their group, of what the gas could be. The students begin with a control experiment to see what happens under known conditions. (Emphasis should be made that yeast is a living organism and sugar is the food it eats.)

(Teacher Note: Observations, predictions and chemical reaction should be recorded in the student's lab books or on the provided worksheet.)

Class discussion: Students share their predictions about what they think the gas is that they have captured. The teacher will guide them to narrow down the predictions to two possible gasses, O_2 or CO_2. Ideas of how to test which gas it is should be discussed. The teacher should lead students to the final test of pouring the gas over a candle to see what will happen. (O_2 gas will continue to burn, CO_2 gas will put the candle out)

(Teacher Note: The amount of gas collected during a class period is minimal. It is also difficult for the students to remove the graduated cylinder, where the gas is collected, while extracting any water remaining in the cylinder without losing the gas in the process. Since CO_2 is heavier than the air in the room the graduated cylinder must be inverted quickly with a hand covering the opening, this is another time when gas is easily lost. ***It may be easiest for the teacher to demonstrate this for the class****.)*

Once the students have determined what the gas is then the teacher should guide them as they create a chemical equation showing the sugar as a reactant and the gas as a product.

(Teacher Note: If the students have already gone through strand 8.1 then they will be familiar with chemical equations. If not then have the students write a simple equation so they can begin to understand how chemical reactions take place.)

Students **plan** their own **investigation** to further *explore* the relationship between matter and energy in this reaction. Their goal will be to explore the cause and effect relationship between the reactants, the energy, and the products. Students can choose from provided materials to conduct their investigation, if they want to change a variable with a material or substance that is not provided they should bring it themselves. Observations, level of yeast growth and gas production, need to be recorded in student journals or on the worksheet.

Reasoning

Students compare their experimental results with the results from the control experiment by creating a bar graph using microsoft excel, google sheets or some other spreadsheet program. Students analyze the results using the graph. The teacher then leads a discussion to help the students read the results and interpret their meaning from the graph.

(Teacher Note: This is a great time to go over how to read a bar graph with your students if you haven't done so before. Use the "Reading Charts and Graphs" or the "Identify and Interpret (I2)" strategy.)

Communicating

Students write a concluding statement explaining the relationship between the reactants, energy, and products from the investigations. They should focus on how the reactants (sugar) affect the amount of energy available to the yeast for growth and how the reactants affect the amount of waste (CO_2) that was produced using evidence from their investigations.

Assessment: Conclusion in the lab write up will be used as a formative assessment. You may also use the exit ticket as the assessment for this episode.	**Materials, resources, handouts, etc:** Investigation Instructions Student Lab Report Sheet Materials to build the culturing apparatus: ● 500 ml Erlenmeyer Flask ● A stopper ● 20 cm of rubber tubing ● 500 ml beaker ● 100 ml graduated cylinder ● Square of plastic wrap Materials needed for the investigation: ● Sugar ● Yeast ● Warm water ● Stop watch ● candle/matches ● Thermometers ● Access to computer lab, laptop lab, tablets, etc. Exit Ticket