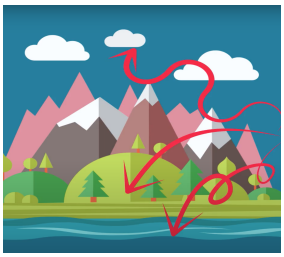
Carbon Dioxide Balloons:
Visualizing Decomposition + Nutrient Cycling

VIDEO: https://youtu.be/kPAijaRfSBU

INTRODUCTION:



The recycling of major nutrients such as carbon (C), hydrogen (H), nitrogen (N), phosphorus (P), and oxygen (O) is an important process that helps sustain generations upon generations of life on Earth. Without nutrient cycling, these resources would be finite, running out long before humans ever existed.

Decomposers are responsible for a significant portion of nutrient cycling. These organisms consume and break down dead organic matter into nutrients that can be reincorporated into the atmosphere, soil, and water. Bacteria, fungi, earthworms, and flies are common examples of decomposers.

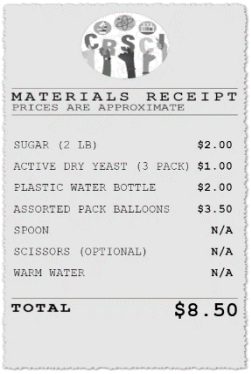
Yeast are single-celled, eukaryotic, fungi that play a crucial role in converting sugar ($C_6H_{12}O_6$) into atmospheric carbon dioxide (CO_2). Sugar, or glucose, is a macromolecule present in various forms of life. It contains an abundance of C, H, and O that can be reused to support more life on Earth when organisms decompose. Below is the chemical reaction for yeast's breakdown of glucose into atmospheric CO_2:

$$\underset{\text{glucose}}{C_6H_{12}O_6} \xrightarrow{\text{yeast}} \underset{\text{ethanol}}{2C_2H_5OH} + \underset{\text{carbon dioxide}}{2CO_2}$$

PURPOSE:

To visualize the decomposition of sugar by yeast to recycle atmospheric carbon dioxide.

PROCEDURE:



MATERIALS RECEIPT
PRICES ARE APPROXIMATE

SUGAR (2 LB)	$2.00
ACTIVE DRY YEAST (3 PACK)	$1.00
PLASTIC WATER BOTTLE	$2.00
ASSORTED PACK BALLOONS	$3.50
SPOON	N/A
SCISSORS (OPTIONAL)	N/A
WARM WATER	N/A
TOTAL	$8.50

1. Stretch out a balloon by continuously blowing it up and down. Set it aside until step 5.
2. Pour one inch of very warm water into an empty and clear plastic bottle.
3. Dissolve one teaspoon of sugar in the warm water. Cap bottle and rigorously shake to ensure sugar has dissolved.
4. Dissolve one packet of active dry yeast in the sugar water solution. Cap bottle and GENTLY stir the yeast to mix with the sugar.
5. Place the balloon securely over the mouth of the bottle. If available, tape around to secure and seal.
6. Let the balloon-bottle model sit for at least one hour.
7. Measure the balloon's circumference with string and a ruler. Record on data table.

DATA/OBSERVATIONS:

Sketch the model. **Label** the yeast, sugar, and/or atmospheric CO_2 on each.

Beginning (0 hours)	End (~1 hours)

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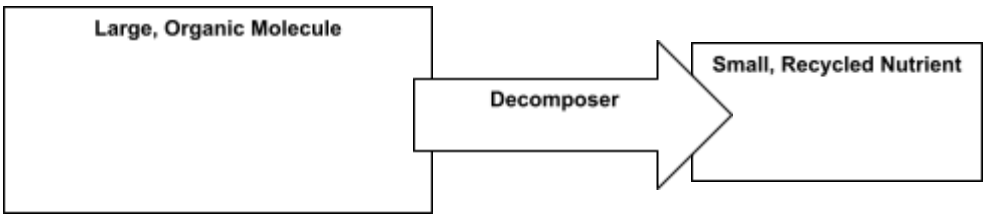
Record the balloon's circumference for each group.

Group								
Circumference (cm)								

CONCLUSION:

1. Out of yeast, sugar, and atmospheric CO_2, **determine** the (1) decomposer at work, the (2) organic molecule being broken down, and the (3) nutrient being recycled.



2. Using observations as evidence, **describe** how you know carbon dioxide (CO_2) was produced from the chemical reaction between yeast and sugar.

3. Which group produced the most CO_2? Use data as evidence to **justify** your answer.

4. **Explain**, in your own words, why decomposers are important for ecosystems.