Green Bananas

Scoring Rubric

Item	Task Description	0 points	1 point	2 points	3 points
1-3	*Analyze and interpret graphs to identify patterns in the amount of starch and glucose in bananas.*	Correctly identifies 1 or no ideas in the rightmost column.	Correctly identifies two of the ideas in the rightmost column.	Correctly identifies three of the ideas in the rightmost column..	Correctly identifies that: • The amount of starch decreases over time • Amount of sugar increases over time • The biggest changes occur between days 18-20 (+/- a day) • As starch levels fall, sugar levels rise OR as sugar levels rise, starch levels fall.
4-5	*Use models to recognize that starch and glucose are made of the same atoms arranged in a similar pattern.*	Does not recognize the atomic similarities between starch and glucose.	Correctly identifies that both starch and glucose contain carbon, hydrogen and oxygen OR Correctly describes the repeating pattern of glucose molecules in starch. OR Student notices items are “the same” but does not name specifics.	Correctly identifies that both starch and glucose contain carbon, hydrogen and oxygen AND Correctly describes the repeating pattern of glucose molecules in starch.	
6	*Explain that as fruit ripens, a chemical reaction occurs.*	Does not provide a correct explanation and does not provide evidence.	Correctly completes the explanation but misses both types of evidence. OR Provides an explanation that is partially correct and one type of evidence.	Correctly completes the explanation but misses one type of evidence. OR Provides an explanation that is partially correct and two types of evidence.	Correctly completes the explanation: As a banana ripens, amylase causes ***a chemical reaction*** that breaks ***starch*** molecules into ***glucose*** molecules. AND Provides evidence from both the graph AND models describing the relationship between starch and glucose.

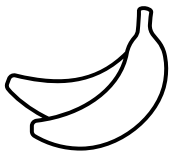
Zhu, L. S., Shan, W., Wu, C. J., Wei, W., Xu, H., Lu, W. J., ... & Kuang, J. F. (2021). Ethylene-induced banana starch degradation mediated by an ethylene signaling component MaEIL2. *Postharvest Biology and Technology*, *181*, 111648.

ONPAR Paper Task
Green Bananas

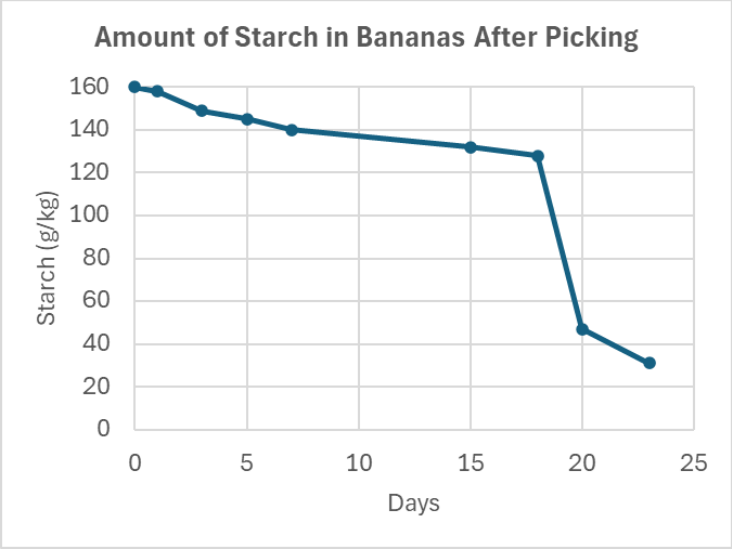
Answer Key

Luca goes to the kitchen to get a banana for breakfast but sees only green bananas, which he thinks taste terrible. Luca decides not to eat the bananas today but knows that if he waits until later the bananas will be yellow and will taste sweet.

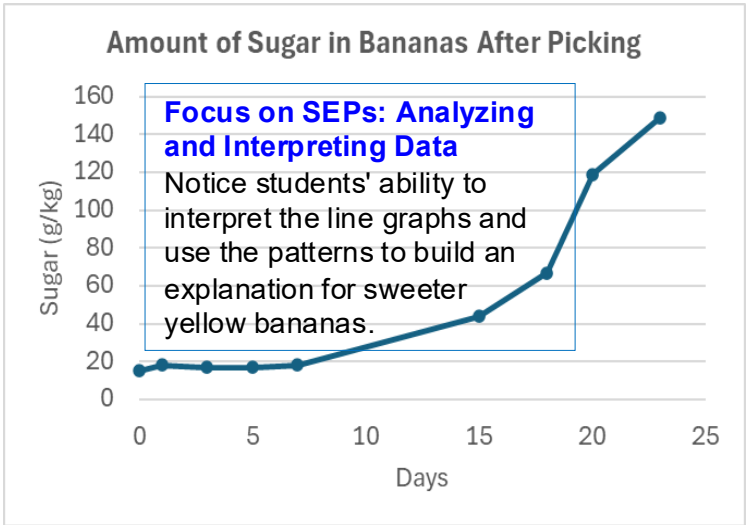
Luca wonders why bananas get sweeter as they get older. Where does the sweetness come from?



Luca investigates the amount of starch and sugar in green bananas after they are picked. The results are found below.



⟸ *green bananas* *yellow bananas* ⟹



Focus on SEPs: Analyzing and Interpreting Data
Notice students' ability to interpret the line graphs and use the patterns to build an explanation for sweeter yellow bananas.

Circle the correct answer(s) and fill in the blanks for each statement.

1. What pattern do you see in the amount of **starch** over time?

It _____*decreases*_____ over time.
increases / decreases / stays the same

The biggest change happens between days _____*18*_____ and _____*20*_____.

2. What pattern do you see in the amount of **sugar** over time?

It _____*increases*_____ over time.
increases / decreases / stays the same

The biggest change happens between days _____*18*_____ and _____*20*_____.

3. What relationship do you see between the amount of starch and the amount of sugar?

As the amount of _____*starch*_____ _____*falls*_____,
starch / sugar *rises / falls*

the amount of _____*sugar*_____ _____*rises*_____.
starch / sugar *rises / falls / stays the same*

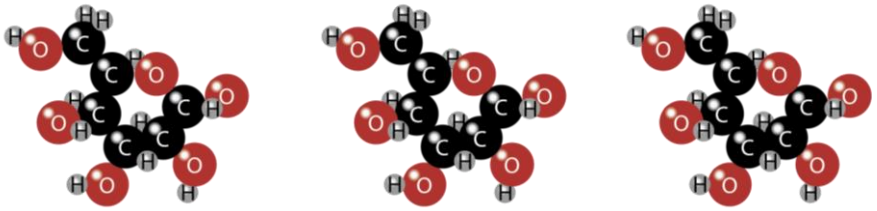
OR as sugar rises, starch falls.

Luca learned that one of the main sugars in ripe bananas is glucose. He analyzed models of starch and glucose molecules to better understand the relationship between them in a banana.

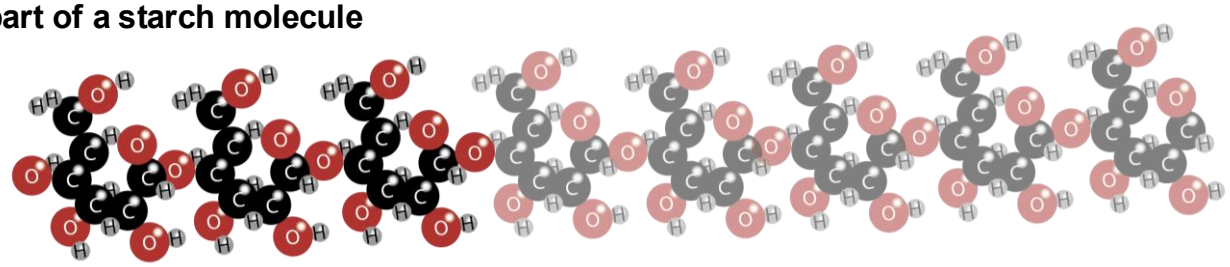
Key

type of atom	symbol
Oxygen	O
Carbon	C
Hydrogen	H

three glucose molecules



part of a starch molecule



4. What pattern do you see in the **types of atoms** in glucose and starch?

Glucose and starch are both made of C, H and O

5. What relationship do you notice in the **arrangement of those atoms** for both glucose and starch?

The atoms are in the same order/have a repeating pattern, Starch seems to be made of glucose over and over..

6. Bananas contain an enzyme called *amylase*, that cuts starch into smaller pieces. Amylase becomes more active when fruit is ripening. Use all the information provided to explain where the sweetness come from in bananas. Circle the correct words to complete the explanation. Then describe the evidence that supports it.

Explanation: As a banana ripens, amylase causes chemical reaction

photosynthesis / a chemical reaction / a physical change / osmosis

that breaks starch molecules into glucose molecules.

starch / glucose *starch / glucose*

Focus on CCCs: Patterns Notice if students use patterns from the graph and models to find the cause for yellow bananas being sweeter.

graphs: We know that the amount of sugar goes up as the amount of starch goes down over time

Supporting evidence from the models: We know that starch molecules are made of glucose molecules.