

Paper Task: Green Bananas

Background

In this task, students figure out how bananas become sweet as they ripen by converting starch to glucose. Paper tasks allow more flexibility for teachers to assess in other ways, while still minimizing the language load for students.

In preparation for this task, students should have an understanding of the *Next Generation Science Standards* (disciplinary core ideas, science and engineering practices, and crosscutting concepts) as outlined in the tables below. This task supports moving toward MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Disciplinary Core Ideas (DCI)
LS1.C: Organization for Matter and Energy Flow in Organisms Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules.

Science and Engineering Practices (SEP)
Analyzing and Interpreting Data - Analyze and interpret data to provide evidence for phenomena. Constructing Explanations and Designing Solutions - Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.

Crosscutting Concepts (CCC)
Patterns Use patterns to identify cause and effect relationships

Learning Progressions

The tasks were designed based on current understanding of learning progression research in science education (National Research Council, 2012). Learning progressions describe how students develop successively more sophisticated ways of reasoning about science content as they obtain more experience with phenomena/representations, and improve their cognitive abilities (Smith, Wiser, Anderson, & Krajcik, 2006).

The Framework for K-12 Science Education (National Research Council, 2012) addresses the progression of Disciplinary Core Ideas (DCIs) throughout the sciences. The focus for the task is on the transformation of matter in living things through chemical reactions. The following are the "Grade Level End Points" identified within the *Framework* (2012).

These endpoints are included here because they summarize the learning progressions intended by the standards prior to middle school and by the end of middle school.

LS1.C: Organization for Matter and Energy Flow in Organisms

By the end of grade 5. Animals and plants alike generally need to take in air and water, animals must take in food, and plants need light and minerals; anaerobic life, such as bacteria in the gut, functions without air. Food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and for motion. Plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their internal conditions (e.g., at night).

By the end of grade 8. Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. Animals obtain food from eating plants or eating other animals. Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. In most animals and plants, oxygen reacts with carbon-containing molecules (sugars) to provide energy and produce carbon dioxide; anaerobic bacteria achieve their energy needs in other chemical processes that do not require oxygen.

(National Research Council, 2012, p. 144)