

TEACHER LESSON KEY

Suggested vocabulary words/phrases. These are found in the context of the animation, and can be defined as the student works through the lesson.

decomposition, specialized cells, interstitial space, cell wall, intracellular, leached, extracellular, cellulose, hemicellulose, lignin, polymer, microbes (more information about them during their own animation), microfibril, phenol

Have the students turn on the captions. This helps address different learning styles, as well as encourages the student to slow down and pause the animation as needed to take notes and answer the questions as they work through the animation.

- I. Understanding plant litter decomposition by understanding leaf anatomy
 1. Look at the image of leaves drifting down from the trees. What does plant litter decomposition have to do with the carbon cycle?
Decomposing plant litter adds carbon to the soil organic carbon pool.
 2. Why is it important to learn about the anatomy of a leaf?
It is important to learn about leaf anatomy to better understand the process of plant litter decomposition.
 3. Leaves are made of many specialized cells, which determine shape, size and function.
- II. Leaf Anatomy
 1. Interstitial space. Where is interstitial space found in a leaf?
Between each of the plant cells
 2. Predict: what is important about this space?
Student prediction might correctly point to it being an opening for decomposers to enter. During the Microbes lesson, this information comes into play.
- III. Cell Wall
 1. What is the function of the cell wall? Where is it located? What happens to intracellular components after leaf fall?
The cell wall supports the leaf structure, protects the cell, and separates the intracellular components from the extracellular environment.
 2. In the image of the plant cell, the thick grayish colored layer with multiple pathways represents the waxy cuticle on the outside of the leaf. Next is the cell wall. What is the layer inside the cell wall called?
The plasma membrane is inside the cell wall.
 3. What is the main target of decomposition?

The primary cell wall

IV. Leaf image and anatomy

1. Draw and label a representation of the images shown. Be sure to include the plasma membrane, hemicellulose, cellulose, lignin, and cell wall.

Students should copy the drawing and label, from the waxy cuticle working inward: the plasma membrane, the bundles of cellulose, the hemicellulose branches wrapping around the cellulose, and the brown lignin in between the bundles.

2. What are the three main components of the primary cell wall?
Cellulose, hemicellulose, and lignin

V. Cellulose

1. Cellulose consists of sugars known as **glucose**. Each individual sugar molecule, the **monomer**, is linked together, forming a long **linear polymer**." These long polymers **group together** to form a **crystalline structure**. Since cellulose consists of **sugars**, it is a high energy fuel. **Microbes** attack it first in **decomposition**.
2. Draw the long linear polymer that groups together to form the crystalline structure of cellulose. What is the molecule represented by each individual green sphere?
Glucose

VI. Hemicellulose

1. What is hemicellulose? It is a **polymer** made of long chains of **sugar molecules**, primarily xylose and arabinose. These are **high energy fuels**. Hemicellulose consists of short chains and has a **branched** structure.
2. What does hemicellulose do? It encases the cellulose to form a **microfibril** and plays an important role in holding everything together. Roots of the word microfibril are: micro: **small** and fibril: **fiber**
3. Draw another cellulose polymer, and this time add the branched hemicellulose. What is this entire unit now called? **A microfibril**

VII. Lignin

1. Lignin is a complex compound made of different kinds of **phenol based molecules**, which are arranged in random patterns to form **polymers**.
2. Lignin **traverses** the spaces between cellulose bundles. It is a **low energy food**, which requires a **lot** of work (energy) to break down, and thus shields the high energy foods of cellulose and hemicellulose. You will learn more about lignin and how it is broken down in the Lesson 3, about Microbes.

VIII. SUMMARIZE

1. Pick up, or imagine, a decaying leaf and write a paragraph about the process of decomposition using the terms intracellular components, polymer, cellulose, glucose, hemicellulose, lignin, and energy

As a leaf decomposes, the first things to leach out are the intracellular components. Next, the primary cell wall is the main target of decomposition. It is made up of cellulose, hemicellulose, and lignin. The high energy glucose molecules of cellulose are attacked first, as hemicellulose molecules wrapping the glucose polymers are also attacked. Lignin is a big blocky molecule filling in the spaces between the bundles of cellulose and hemicellulose. Lignin requires a lot of energy to break down, and it shields the cellulose and hemicellulose.

2. What questions does this information lead you to? **Students might predict a need to know how lignin is broken down, which is addressed in the Microbes animation.**