

Wood properties

There are more than 1.5 million wood cells in one cubic centimetre of wood. A strong composite is formed when they are packed together. Each individual wood cell is a multilayered, fundament-reinforced, closed-end tube rather than just a homogeneous-walled, non-reinforced straw. So it is even more structurally advanced.

There are four distinct cell wall layers in each individual cell. Each layer consists of a combination of three chemical polymers: cellulose, hemicellulose, and lignin.

Cellulose and **hemicellulose** are linear polysaccharides, and the **lignin** is an amorphous phenolic. Cellulose forms long unbranched chains while hemicellulose forms short branched chains.

Lignin encrusts and stiffens these polymers. Carbohydrate and phenolic components of wood are assembled in a layered tubular or cellular manner with a large cell cavity, so specific gravity of wood can vary immensely. Wood is a good building material because the layered tubular structure has a large volume of voids (void volume); it has an advantageous strength-to-weight ratio. It is resistant to corrosion, it is economical and easily modified.

Bark, wood, and cambium are the three categories in which the cross-section of a tree is divided.

Bark is the outer layer. It consists of a dead outer phloem of dry corky material and a thin inner phloem of living cells. Its primary functions are protection and nutrient conduction. The thickness and appearance of bark vary substantially depending on the species and age of the tree;

Wood, or xylem, is the inner sections of the trunk. The primary functions of wood are support and nutrient conduction and storage.

Wood is divided into two classes:

- **sapwood**: its functions are primarily in food storage and the mechanical transport of sap. The radial thickness of sapwood is commonly 35 to 50 mm but may be 75 to 150 mm for some species;
- **heartwood** is the inner core of wood cells that have changed, both chemically and physically, from the cells of the outer sapwood. Deposits of various materials give heartwood a much darker colour. Extractive deposits make some species of heartwood more durable in conditions.

Cambium is a continuous ring of reproductive tissue. It is situated between the sapwood and the inner depending on the season. Each cell in a radial line is originated from the same cambial cell so all wood and bark cells are aligned or stacked radially. Growth in trees is affected by the soil and environmental conditions.

Activities

True (T) or False (F)?

- T F** 1) The cross-section of a tree is divided into three broad categories: bark, wood, and cambium.
- T F** 2) Each individual cell has six distinct cell wall layers.
- T F** 3) The cellulose and hemicellulose are linear polysaccharides.
- T F** 4) Specific gravity of wood can vary immensely.
- T F** 5) Wood has many advantages, such as corrosion resistance, fatigue resistance, low cost.
- T F** 6) The lignin is an amorphous phenolic.
- T F** 7) Cellulose forms short unbranched chains.
- T F** 8) Hemicellulose forms long branched chains.

Tick the correct answer

1) Each layer is composed of a combination of:

- a) two chemical polymers.
- b) three chemical polymers.
- c) three chemical polymers.

2) The radial thickness of sapwood is:

- a) commonly 35 to 50 mm but may be 75 to 150 mm for some species.
- b) commonly 45 to 60 mm but may be 85 to 160 mm for some species.
- c) commonly 55 to 70 mm but may be 95 to 170 mm for some species.

3) One cubic centimeter of wood could contain:

- a) more than 2.5 million wood cells.
- b) more than 3.5 million wood cells.
- c) more than 1.5 million wood cells.

Complete the sentences with the correct word

- 1) Bark's primary functions are and nutrient conduction.
- 2) The thickness and appearance of bark substantially depending on the species and age of the tree.
- 3) Wood, or xylem, is composed of the sections of the trunk.
- 4) The cell cavities of heartwood may contain deposits of materials that give a much darker colour.
- 5) Extractiveformed during the conversion of living sapwood to dead heartwood make the heartwood more durable.
- 6) Cambium is a continuous ring of reproductive located between the sapwood and the inner depending on the season.
- 7) Growth in trees is affected by the soil and conditions.
- 8) The primary functions of wood are support and conduction and storage.

Keys

True (T) or False (F)?

- F** 1) The cross-section of a tree is divided into three broad categories: bark, wood, and cambium.
- T** 2) Each individual cell has six distinct cell wall layers.
- F** 3) The cellulose and hemicellulose are linear polysaccharides.
- F** 4) Specific gravity of wood can vary immensely.
- F** 5) Wood has many advantages, such as corrosion resistance, fatigue resistance, low cost.
- F** 6) The lignin is an amorphous phenolic.
- T** 7) Cellulose forms short unbranched chains.
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Complete the sentences with the correct word

- 1) Bark's primary functions are PROTECTION and nutrient conduction.
- 2) The thickness and appearance of bark VARY substantially depending on the species and age of the tree.
- 3) Wood, or xylem, is composed of the INNER sections of the trunk.
- 4) The cell cavities of heartwood may contain deposits of materials that give HEARTWOOD a much darker colour.
- 5) Extractive DEPOSITS formed during the conversion of living sapwood to dead heartwood make the heartwood more durable.
- 6) Cambium is a continuous ring of reproductive TISSUE located between the sapwood and the inner depending on the season.
- 7) Growth in trees is affected by the soil and ENVIRONMENTAL conditions.
- 8) The primary functions of wood are support and NUTRIENT conduction and storage.