

Name _____ Date _____

Concept Covered: Common Types of Plant Cells

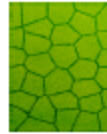
1. List the cell structures that are found only in plant cells.

2. List three types of specialized plant cells. _____

3. Describe the structure and function of parenchyma cells.

4. Describe the structure and function of collenchyma cells.

5. Describe the structure and function of sclerenchyma cells.



Teacher Answer Key

1. Large central vacuole, plastids, and cell wall.
2. Parenchyma, collenchyma, and sclerenchyma.
3. **Parenchyma:**
 - Loosely packed cells that contain a large central vacuole, and have thin, flexible cell walls.
 - These cells are involved in many metabolic functions including photosynthesis, the storage of food and water, and the healing of injured tissues.
 - These cells usually form the bulk of a nonwoody plant.
4. **Collenchyma:**
 - These cells have thicker walls than parenchyma cells.
 - They are irregular in shape, and have thick cell walls that provide support to the plant.
 - They are specialized for supporting regions of the plant that are still lengthening and actively growing.
5. **Sclerenchyma:**
 - These cells have thick and rigid cell walls.
 - They are specialized for supporting regions of the plant that are no longer growing.
 - These cells often die at maturity, providing a framework of support for the plant.

Name _____ Date _____

Concept Covered: Dermal and Ground Tissues

1. What is a tissue? _____

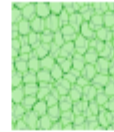
2. Where are dermal tissues found? _____
3. What is epidermis? What type of cells compose it? _____

4. What additional layer may be found on the epidermis? What is the function of this layer? _____

5. What openings are found in leaf and stem epidermis? What is their function? _____

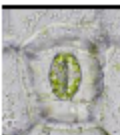
6. In old woody stems, what replaces the epidermis? _____
7. What types of cells compose the ground tissues? _____

8. List the functions of the ground tissues. _____



Teacher Answer Key

1. A tissue is a group of cells that work together to perform a specific function.
2. Dermal tissues form the outer covering of the plant body.
3. The epidermis consists of the cells that form the outer covering of the plant. The epidermis is composed of parenchyma cells.
4. The epidermis secretes a waxy layer called cuticle. The cuticle helps to prevent water loss from the plant.
5. The openings are called stomata. They regulate the passage of gases (carbon dioxide and oxygen) and water into and out of the leaf.
6. Dead cork cells.
7. Ground tissues are composed of all three cell types: parenchyma, collenchyma and sclerenchyma.
8. Functions of ground tissues include:
 - Storage of water and nutrients.
 - Photosynthesis in leaves.
 - Support in the roots and stems.



Name _____ Date _____

Concept Covered: Gas Exchange in Leaves

1. What gas enters the leaf? _____
2. What gas exits the leaf? _____
3. How does this gas exchange occur? _____

4. In what way are the stomata a disadvantage to the plant?

5. What are guard cells? _____

6. Describe the process that causes the stomata to open.

7. Describe the process that causes the stomata to close.



Teacher Answer Key

1. Carbon dioxide.
2. Oxygen.
3. Gas exchange occurs through stomata. Stomata are pores in the leaf that open to receive carbon dioxide and release oxygen.
4. While the stomata are open to let in carbon dioxide, water vapor is lost to the atmosphere.
5. Guard cells are the two kidney-shaped cells that border each stoma. These cells regulate the opening and closing of the stomata.
6. Potassium ions are pumped into the guard cells. This creates a difference in the concentration gradient which causes water to enter the guard cell by osmosis. The guard cells swell which causes them to pull apart creating a pore or opening to the outside of the leaf.
7. Potassium ions are pumped out of the guard cells. This causes water to leave the guard cells by osmosis. The guard cells collapse and the stoma closes.



Name _____ Date _____

Concept Covered: Introduction to Plant Anatomy

1. The vascular plants have 3 main organs that compose them. List these three organs and briefly describe their function.

➤ _____

➤ _____

➤ _____

2. Vascular plants also have several specialized organs. Describe what each of the following is specialized for:

a) Flowers: _____

b) Fruits: _____

c) Cones: _____

3. The plant body is composed of three different tissue systems. These tissue systems are found continuously throughout the plant. List these three tissue systems and give a brief description of each.

➤ _____

➤ _____

➤ _____



Teacher Answer Key

1. **Roots:**

- Anchor the plant to the ground.
- Absorb water and minerals.
- May serve as a storage area for food.

Stems:

- Produce leaves and displays them to the sun.
- Conduct water and minerals upward.
- Transport food downward.

Leaves:

- Site of photosynthesis.

2. **Flowers:** Specialized for reproduction.

Fruits: To carry and disperse seeds.

Cones: To carry and disperse seeds.

3. **Dermal Tissues:** The outer protective covering for the entire plant body.

Vascular Tissues: Composed of tubes of xylem and phloem to transport food and water throughout the plant.

Ground Tissues: Consists of all the tissues that are neither epidermal nor vascular. Cells are specialized for storage, photosynthesis and support.


Name _____ Date _____

Concept Covered: Leaves 1

- Most leaves are thin and flat. Why is this a good adaptation?

- List two common functions of leaves. _____

- Label the petiole, the blade and veins in the drawing below. Then define each term.



Petiole: _____

Blade: _____

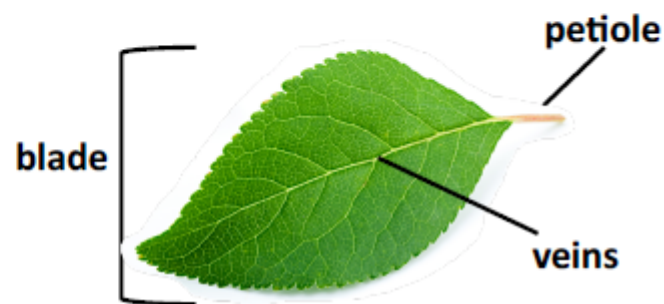
Vein: _____

- How is the venation different in monocots and dicots?



Teacher Answer Key

- It allows the leaf to effectively capture the sunlight needed for photosynthesis.
- Photosynthesis and transpiration.
-



Petiole: Attaches the leaf to the stem

Blade: The broad and flat portion of the leaf that is the site of photosynthesis

Vein: Bundles of vascular tissue.

- Monocots have parallel venation. Dicots have netted venation.



Name _____ Date _____

Concept Covered: Leaves 2

Find and label these structures in the drawing of the leaf below:
Cuticle, vein, palisade cells, upper epidermis, phloem, spongy cells,
stomata, mesophyll, air space, xylem, guard cells, lower epidermis.



Give the function of each of the following:

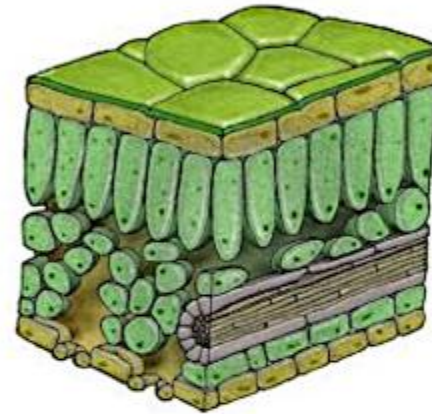
1. Epidermis: _____
2. Cuticle: _____
3. Palisade cells: _____
4. Spongy cells: _____
5. Mesophyll: _____
6. Stomata: _____
7. Guard cells: _____
8. Vein: _____



Name _____ Date _____

Concept Covered: Leaves 2

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Give the function of each of the following:

1. Epidermis: _____
2. Cuticle: _____
3. Palisade cells: _____
4. Spongy cells: _____
5. Mesophyll: _____
6. Stomata: _____
7. Guard cells: _____
8. Vein: _____



Name _____ Date _____

Concept Covered: Leaves 3

1. Distinguish between simple leaves and compound leaves. Draw an example of each. _____

2. List and describe three types of specialized leaves.

- _____
- _____
- _____

3. Where are most stomata found in a leaf. Why is this an advantage? _____

4. Explain why leaves change colors in the fall. _____



Teacher Answer Key

1. Simple leaves have a single blade. Compound leaves have a blade that is divided into two or more leaflets.



Simple Leaf



Compound leaf

2. **Carnivorous plants** have tube shaped leaves to trap insects.

Spines are leaves modified to protect plants from animals.

Tendrils enable vines to creep and climb along surfaces.

3. They are generally found on the lower surface of the leaf. This adaptation reduces water loss by keeping the stomata out of direct sunlight.

4. Leaves appear green because of the abundance of chlorophyll. During the fall, temperatures drop and chlorophyll formation is no longer possible. The remaining chlorophyll is used up, and the other pigments begin to show through.



Name _____ Date _____

Concept Covered: Meristematic Tissues

1. What are meristems or meristematic tissues? _____

2. Name two types of meristematic tissue. Describe how each affects the growth of a plant.

3. There are two types of lateral meristems. Name and describe each.

4. Distinguish between primary growth and secondary growth.



Teacher Answer Key

1. Meristematic tissues are tissues that are capable of unlimited cell division resulting in the growth of the plant.

2. **Apical meristems:** This tissue is found at the tips of stems and roots. These cells divide causing the plant to grow in length.

Lateral meristems: This tissue is located on the outside of stems and roots. These cells divide causing the plant to grow in width/diameter.

3. **Vascular cambium:** Located between the xylem and the phloem, these cells divide to produce additional vascular tissue.

Cork cambium: Located outside the phloem, this tissue produces cork. Cork cells will replace the epidermis in woody stems and roots, providing protection, and preventing the loss of water from the plant.

4. **Primary growth:** Growth in length (apical meristems.)

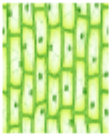
Secondary growth: Growth in diameter (lateral meristems.)

Name _____ Date _____

Concept Covered: Overview of Tissue Systems

List each tissue system in the chart below. Complete the corresponding questions for each.

Name of Tissue System	Location in Plant Body	Function in Leaves	Function in Stems	Function in Roots



Teacher Answer Key

Name of Tissue System	Location in Plant Body	Function in Leaves	Function in Stems	Function in Roots
Dermal Tissue System	The outermost layer of cells.	Absorption, gas exchange, and protection.	Gas exchange and protection.	Protection.
Vascular Tissue System	Forms tubes that extend from top to bottom of the plant.	Transport of water up the plant and glucose down the plant. Aids in structural support.	Transport of water up the plant and glucose down the plant. Aids in structural support.	Transport of water up the plant and glucose down the plant. Aids in structural support.
Ground Tissue System	In between the dermal and vascular tissues in nonwoody plants.	Photosynthesis	Structural support and storage.	Structural support and storage.



Name _____ Date _____

Concept Covered: Roots 1

- List the functions of roots. _____

- There are two main types of root systems. Describe each. Give an example of a plant that has each type.
 - Taproot system: _____

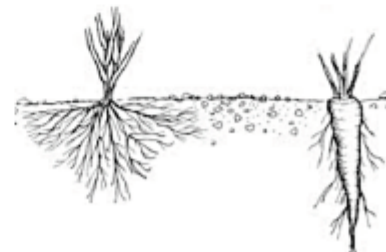
 - Fibrous root system: _____

- Make a simple sketch of each type of root system. Label each type.



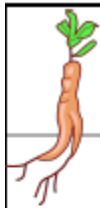
Teacher Answer Key

- Functions of roots include:
 - Anchors the plant in the soil.
 - Absorbs water and minerals from the soil.
 - Provides storage areas for excess water and food.
- Taproot system:**
 - Consists of one main vertical root (taproot) with smaller lateral roots branching off.
 - A carrot is a taproot. All dicot plants have a taproot system.
- Fibrous root system:**
 - The growth of the primary root is surpassed by the growth of the secondary roots.
 - It is a mass of lateral roots that spread out just below the soil surface.
 - Found in monocots, such as corn.
- Student Sketch should be similar to this:



Fibrous root system

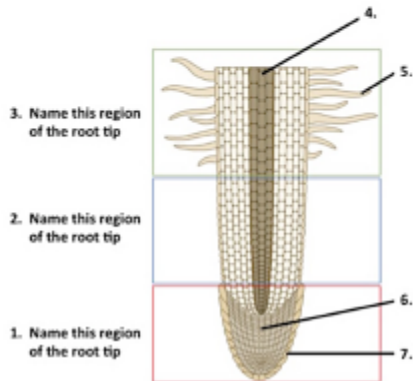
Taproot system



Name _____ Date _____

Concept Covered: Roots 2

Label each of the numbered parts seen in the drawing below. Give a brief definition for each.



1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____



Teacher Answer Key

1. **Meristematic region:** A zone of rapid and nearly unlimited cell division. Responsible for the growth of the root.
2. **Region of Elongation:** Cell division ceases and the cells lengthen in a downward direction, pushing the root down into the soil.
3. **Region of Maturation:** The cells mature and specialize into tissues with specific functions.
4. **Vascular cylinder:** Found at the center of the root. The vascular cambium divides to form xylem and phloem.
5. **Root hairs:** Increases the surface area for the absorption of water and minerals.
6. **Apical meristem:** This tissue is found at the tips of stems and roots. These cells divide causing the plant to grow in length. Responsible for primary growth.
7. **Root cap:** Covers the delicate root tip and protects it as it is pushed through the soil. It secretes a slimy substance which provides lubrication as the tip is pushed through the soil.

Name _____ Date _____

Concept Covered: Roots 3

This drawing shows a cross section of a dicot root. Label each of the numbered parts seen in the drawing. Give a brief definition for each structure.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____



Teacher Answer Key

1. **Epidermis:** The outermost region of the root. It functions in absorption and protection.
2. **Cortex:** A very thick area of storage parenchyma cells.
3. **Endodermis:** The innermost layer of the cortex. It is one cell thick. It is thickened with waxy materials to prevent water loss from the vascular cylinder.
4. **Pericycle:** The outermost layer of the vascular cylinder. It is the site of formation of the secondary roots.
5. **Vascular cylinder or Stele:** This center portion of the root is composed of the endodermis, pericycle, xylem and phloem.
6. **Xylem:** Carries water up the plant.
7. **Phloem:** Tubes that transport glucose throughout the plant.
8. **Root hairs:** Increases the surface area for the absorption of water.



Name _____ Date _____

Concept Covered: Roots 4

1. What are adventitious roots? List examples. _____

2. Many roots form partnerships with mycorrhizal fungi. Describe this relationship. What type of symbiosis is this?

3. Describe the differences in the arrangement of vascular tissue in monocot and dicot roots. _____



Teacher Answer Key

1. Adventitious roots are specialized roots that grow out from stems and leaves. The prop roots of corn grow from the stem and are specialized to keep the plant upright. The air roots of orchids are specialized to obtain water from the air.

2. Mycorrhizal fungi grow around the roots of a plant. The fungal hyphae increase the surface area for the absorption of water, and aid in anchoring the plant. The heterotrophic fungi benefit from the food stored in the roots of the plant. This is a mutualistic relationship.

3. **Dicots:** The xylem makes up the central core of the root. The xylem forms an "X" at the root center. The smaller tubes of phloem are found to the outside of the larger tubes of xylem.

Monocots: The center of the root is filled with pith, a mass of parenchyma cells. Xylem is found in patches surrounding the pith. Small areas of phloem occur between the xylem patches.

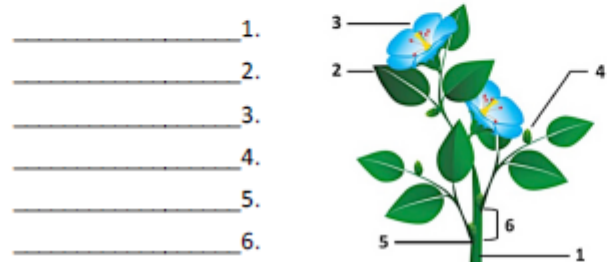


Name _____ Date _____

Concept Covered: Stems 1

1. List the functions of stems. _____

2. Label the parts of the shoot system seen in the drawing below.



3. Define each of the following terms:
a) Node: _____

a) Internode: _____

a) Bud: _____

a) Bud scale: _____

4. Distinguish between lateral buds and terminal buds. _____



Teacher Answer Key

- Functions of stems include:
 - Transportation of water, minerals and nutrients throughout the plant.
 - Display the leaves to the sun.
 - Some stems are specialized for food and water storage.

- Labeling the diagram:
 - 1 – Stem
 - 2 – Leaf
 - 3 – Flower
 - 4 – Bud
 - 5 – Node
 - 6 – Internode

3. **Node:** Points along a stem where leaves are produced and new branches are forming.

Internode: Stems are divided into segments called internodes. It is the area or space between two nodes.

Bud: Develops into a new shoot.

Bud scales: A protective covering for a bud until it opens.

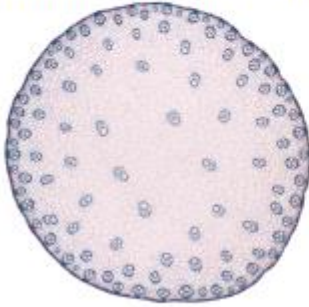
4. **Terminal buds** are located at the tip of the stem. They are responsible for the elongation of the young shoot.
Lateral buds are found on the side of a stem. They grow into lateral shoots that may become leaves or flowers.



Name _____ Date _____

Concept Covered: Stems 2

Below is a drawing showing a monocot stem. Label each of these structures on the drawing: Epidermis, vascular bundles, ground tissue.



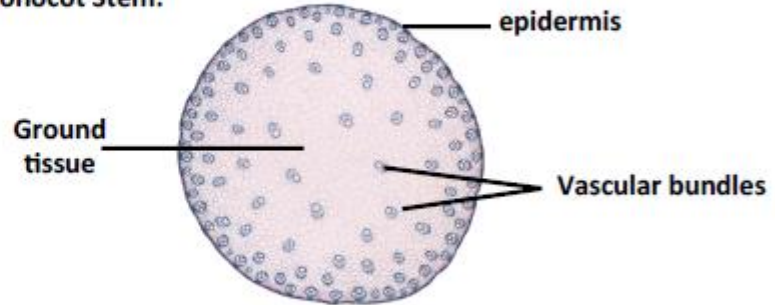
Below is a drawing showing a dicot stem. Label each of these structures on the drawing: Epidermis, pith, cortex, vascular bundles.

What obvious difference is seen between the monocot and dicot stem? _____

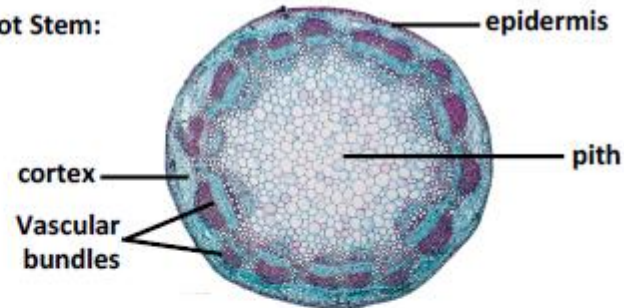


Teacher Answer Key

Monocot Stem:



Dicot Stem:



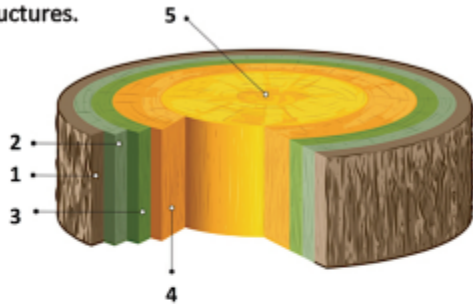
In monocots, the vascular bundles are scattered throughout the stem. In dicots, the vascular bundles are arranged in a ring around the edge of the stem.



Name _____ Date _____

Concept Covered: Stems 3

Below is a cross section of an old, woody stem. Label each of the numbered structures.



_____ 1. _____ 4.
 _____ 2. _____ 5.
 _____ 3.

Define each of the following terms:

6. Woody tissue: _____

7. Heartwood: _____

8. Sapwood: _____

9. Bark: _____

10. Cork cambium: _____

11. Vascular cambium: _____



Teacher Answer Key

1. Cork / cork cambium
2. Phloem
3. Vascular cambium
4. Xylem / Sapwood
5. Xylem / Heartwood
6. Woody tissue: Formed by several layers of xylem concentrated in the center of the stem/trunk.
7. Heartwood: The nonfunctional darker wood in the center of the tree.
8. Sapwood: The functional lighter-colored wood near the outside of the trunk.
9. Bark: The protective outer covering of woody plants. It consists of cork, cork cambium, and phloem.
10. Cork cambium: Produces the cork which is the outer covering of the trunk.
11. Vascular cambium: Produce vascular tissue and increases the thickness of the stem over time.



Name _____ Date _____

Concept Covered: Stems 4

Many plants have stems that are modified and adapted for a particular function. Give the definition of each modified stem below. List an example of each.

1. Tubers: _____

2. Bulbs: _____

3. Corms: _____

4. Rhizomes: _____



Teacher Answer Key

1. A tuber is a stem that is modified for storing food. It usually is found growing underground. An example is a white potato.
2. A bulb is composed of a central stem surrounded by short, thick leaves. The leaves wrap around and protect the stem. The bulb is also an area of food storage. The bulb may remain dormant for a period of time before growing into a new plant. Examples include the lily, the tulip and the amaryllis.
3. A corm looks very similar to a bulb and is often mistaken for a bulb. It is a thickened stem that stores food. The outer layers consist of thin leaves. Examples include crocus and gladiolus.
4. A rhizome is a horizontal underground stem. Examples include ginger and iris.



Name _____ Date _____

Concept Covered: Translocation

1. What is translocation? _____

2. Define the terms "source" and "sink" as it relates to translocation.
 - Source: _____

 - Sink: _____

3. What tubes are used to move carbohydrates through a plant?

4. The mechanism of moving carbohydrates throughout the plant is explained by the pressure-flow hypothesis. Describe this hypothesis. _____



Teacher Answer Key

1. Translocation is the movement of carbohydrates through the plant from source to sink.
2. Source: The area of the plant where the carbohydrates are made.

Sink: The area of the plant where the carbohydrates will be used or stored.
3. Phloem
4. Active transport is used to move carbohydrates into sieve tubes at the source. Water from the xylem is transported into the sieve tubes by osmosis at the source. This creates a positive pressure at the source.

At the sink, carbohydrates are actively transported out of the sieve tubes, water leaves the sieve tubes by osmosis, and pressure is reduced.

This difference in pressure is responsible for the flow from source to sink.



Name _____ Date _____

Concept Covered: Transpiration

1. Through what structures is water transported through the plant? _____

2. Define transpiration. _____

3. Why does water loss occur? _____


4. Explain how water is transported long distances from the roots to the leaves. _____



Teacher Answer Key

1. Water is transported through xylem (vessel elements and tracheids.)
2. Transpiration is the loss of water from the leaves.
3. The stomata in the leaves open to obtain the carbon dioxide that is required for photosynthesis. While the stomata are open, large amounts of water vapor escape through the pores into the atmosphere.
4. Water is literally pulled up the plant by the attraction that exists between water molecules. The water molecules stick to one another because of cohesion. The water molecules to to the sides of the xylem walls because of adhesion. As a result, a thin continuous column of water extends from the leaves, through the stems, and into the roots. As a molecule of water pulls away from the column to escape from the stomata, it pulls on the water molecules in the column below. This pull extends all the way to the bottom of the column in the roots.

Name _____ Date _____

 **Concept Covered: Vascular Tissues 1**

1. What are the functions of the vascular tissues? _____

2. List the two types of vascular tissue. Give the function of each.
✓ _____

✓ _____

3. What are the two types of specialized cells that compose xylem? Describe each.
✓ _____

✓ _____

4. Describe the specialized cells that compose phloem. _____

5. Are the cells composing xylem dead or alive at maturity?

6. Are the cells composing phloem dead or alive at maturity?



Teacher Answer Key

1. The vascular tissues transport glucose and water throughout the plant. They also provide structural support for the plant.
2. **Xylem** carries water and minerals from the roots upward in the plant. It also provides structural support to the plant.

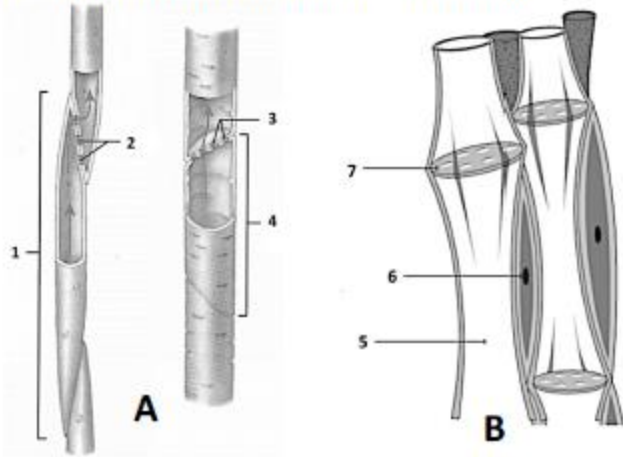
Phloem carries glucose from the leaves throughout the plant.
3. Two types of cells that compose xylem:
Tracheids: These cells are long, thick-walled sclerenchyma cells with tapering ends. These cells are not joined end to end, but rather, overlap one another. Water moves from one cell to the next through openings called pits in the walls of the cells.
Vessel elements: These are sclerenchyma cells that have holes at each end. These cells are joined end to end to form long hollow tubes.
4. The individual cells composing phloem are called sieve tube elements. They are joined to form long sieve tubes. Compounds move from cell to cell through end walls called sieve plates. Companion cells are found along the sieve tubes to assist in the transport of glucose.
5. Dead
6. Alive



Name _____ Date _____

Concept Covered: Vascular Tissues 2

Label each numbered structure in the drawings below.



- | | |
|---------|---------|
| _____ 1 | _____ 5 |
| _____ 2 | _____ 6 |
| _____ 3 | _____ 7 |
| _____ 4 | |

8. Is the drawing at "A" xylem or phloem? _____
9. Is the drawing at "B" xylem or phloem? _____
10. What has happened to the cell organelles in these vascular tubes? Explain. _____
- _____
- _____
- _____



Teacher Answer Key

1. Tracheid
2. Pits
3. Pores
4. Vessel elements
5. Sieve tube element
6. Companion cell
7. Sieve plate
8. Xylem
9. Phloem
10. The xylem is dead and has no organelles. The living sieve tube elements do not have a nucleus or ribosomes. This reduction in cell contents allows nutrients and water to flow more easily.