**Plant Form and Function Guided Notes**

Naming the vegetative plant parts

Vegetative plant parts include stems, leaves, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These organs work together.

Vegetative plant parts: the shoot

The shoot is the aboveground part of the plant.

Vegetative plant parts: the stem

The shoot’s stem supports the leaves, which produce carbohydrates by photosynthesis.

Vegetative plant parts: the roots

Some of the sugar produced in the shoot system travels through the stem to the roots, which are usually below ground.

Vegetative plant parts: functions of roots

Roots anchor the plant and absorb water and minerals that move via the stem to the leaves.

Later, we will explore how water, minerals, and sugars travel through plants.

Vegetative plant parts: nodes and internodes

Leaves attach to stems at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Spaces between nodes are internodes.

Vegetative plant parts: axillary buds

Each node also features an axillary bud, an undeveloped shoot that could form

a new branch or flower.

Two types of plants

Biologists divide plants into two categories based on the characteristics of the stem.

Herbaceous and woody plants

A herbaceous plant has a green, soft stem.

A woody plant is made of tough, bark-covered wood.

Vegetative plant parts: specialized stems

Natural selection produces stems, leaves, and roots with various forms.

Vegetative plant parts: specialized leaves

Natural selection produces stems, leaves, and roots with various forms.

Vegetative plant parts: specialized roots

Natural selection produces stems, leaves, and roots with various forms.

Plant cells build tissues

We’ve seen the organs and organ systems of plants. Now let’s zoom in and learn about the cells and tissues that make up these organs.

Three main tissue types

Plants have three main tissue types:

Ground tissue makes up most of the plant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Vascular tissues (xylem and phloem) transport materials within the plant.

Dermal tissue covers the plant.

Functions of ground tissue

The cells that compose ground tissue are important sites of photosynthesis, respiration, storage, and support.

Vascular tissue

Vascular tissues transport water, minerals, carbohydrates, and other dissolved compounds.

Vascular tissue: xylem

Xylem tissue transports water and minerals from the roots to other plant parts. It consists of long, narrow cells called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and wide, barrel-shaped cells called vessel elements.

Vascular tissue: phloem

Phloem tissue transports dissolved organic compounds like sugars. Sieve tube elements are the conducting cells; they are separated by sieve plates.

Vascular tissue: phloem cells

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells transfer materials in and out of sieve tubes.

Dermal tissues

Dermal tissue covers the plant; it consists of the epidermis, which is coated with a waxy cuticle.

Cuticle and stomata

The cuticle conserves water and protects the plant. Pores in the cuticle, called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, allow leaves to exchange gases with the atmosphere.

Guard cells

Guard cells surround each stoma and control its opening and closing.

Tissues build stems, leaves, and roots

The three tissue types make up the stems, leaves, and roots of the plant.

Let’s look at each of these organs, starting with the stem.

Tissue types found in a stem

Ground tissue occupies most of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- of a herbaceous plant.

Vascular bundles are embedded in the ground tissue.

Dermal tissue covers the stem.

Arrangement of tissues differs in monocots and eudicots

Monocots and eudicots have different arrangements of vascular tissue and ground tissue in their stems.

Vascular bundles in monocot and eudicot stems

In monocots, vascular bundles are scattered throughout the stem.

In eudicots, vascular bundles are arranged in a ring near the epidermis.

The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is ground tissue that fills the space between the epidermis and vascular bundles. The pith occupies the center of the stem.

Tissues found in leaves

Ground tissue occupies most of a leaf.

Vascular bundles are embedded in the ground tissue.

Dermal tissue covers the leaf.

The structure of leaves

Leaves are flattened blades supported with a stalk-like petiole.

Simple vs. compound leaves

Simple leaves have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ blades.

Compound leaves are divided into leaflets attached to one petiole.

Vein patterns on monocot and eudicot leaves

Veins are vascular bundles inside leaves. Many monocots have parallel veins; most eudicots have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ veins.

Mesophyll: the middle of a leaf

Leaf anatomy shown here is that of a eudicot plant.

The ground tissue inside a leaf is called mesophyll, which consists of cells with abundant chloroplasts that produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by photosynthesis.

Stomata: locations of gas exchange

When stomata are open, mesophyll cells exchange gases with the atmosphere.

Mesophyll cells interact with vascular tissue

Mesophyll cells also exchange materials with vascular tissues.

Monocot leaf structures

Monocots have similar leaf anatomy to dicots. Note the prominent bundle sheath cells in this monocot leaf, surrounded by a layer of mesophyll.

Tissues of the root

In a root, ground tissue surrounds a central core of vascular tissue.

Dermal tissue forms the root epidermis.

Fibrous roots vs. taproots

Roots might form a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ root system or a taproot system.

Fibrous roots are slender, shallow, and arise from the base of the stem.

Taproots are thick, deep, and have fewer branches than fibrous roots.

Root hairs

Near each root’s tip, root hairs are extensions of the epidermis that

absorb water and minerals.

Plants have flexible growth patterns

Some plants never stop \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These plants have indeterminate growth.

Plants that stop growing when they reach their mature size have determinate growth.

Meristems

Plants grow by adding units, or modules, consisting of repeated nodes and internodes. Growth occurs at meristems, regions of active cell division.

Apical meristems

Apical meristems produce tissues that lengthen the tips of shoots and roots.

Primary growth

Primary growth occurs at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ meristems. New cells can differentiate into any tissue type.

Intercalary meristems

Intercalary meristems occur at the base of a leaf blade.   
Grasses tolerate grazing because they have intercalary meristems that regrow a leaf from its base when the tip is munched off.

Secondary growth

Secondary growth thickens roots and stems; this growth occurs at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ meristems.

Secondary growth in woody plants

Secondary growth occurs in woody plants. Two types of lateral meristems produce wood and bark:

Vascular cambium

Cork cambium

Vascular cambium

The vascular cambium (highlighted green) produces secondary xylem toward the inside of the stem and secondary phloem toward the outside.

Wood

Secondary xylem is more commonly called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Rays

The vascular cambium also produces rays (highlighted with yellow), bands of parenchyma that extend from the center of the stem or root and transport nutrients laterally.

Bark

Secondary growth produces \_\_\_\_\_\_\_\_\_\_\_\_\_, a collective term for all tissues outside of the vascular cambium.

Cork cambium

The cork cambium (highlighted white) produces parenchyma cells toward the inside and dense, waxy cells called cork toward the outside.

Cork is the outer protective layer of bark.

Periderm

Together, the cork cambium, parenchyma cells, and nonliving cork make up the periderm, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ layer that covers a woody stem or root.

Heartwood

Secondary xylem eventually becomes unable to conduct water, forming heartwood.

Sapwood

The lighter sapwood transports water and dissolved minerals.

Tree rings

Tree rings arise from alternating moist and dry seasons. Wood that forms in the spring has larger cells than wood that forms in the summer.