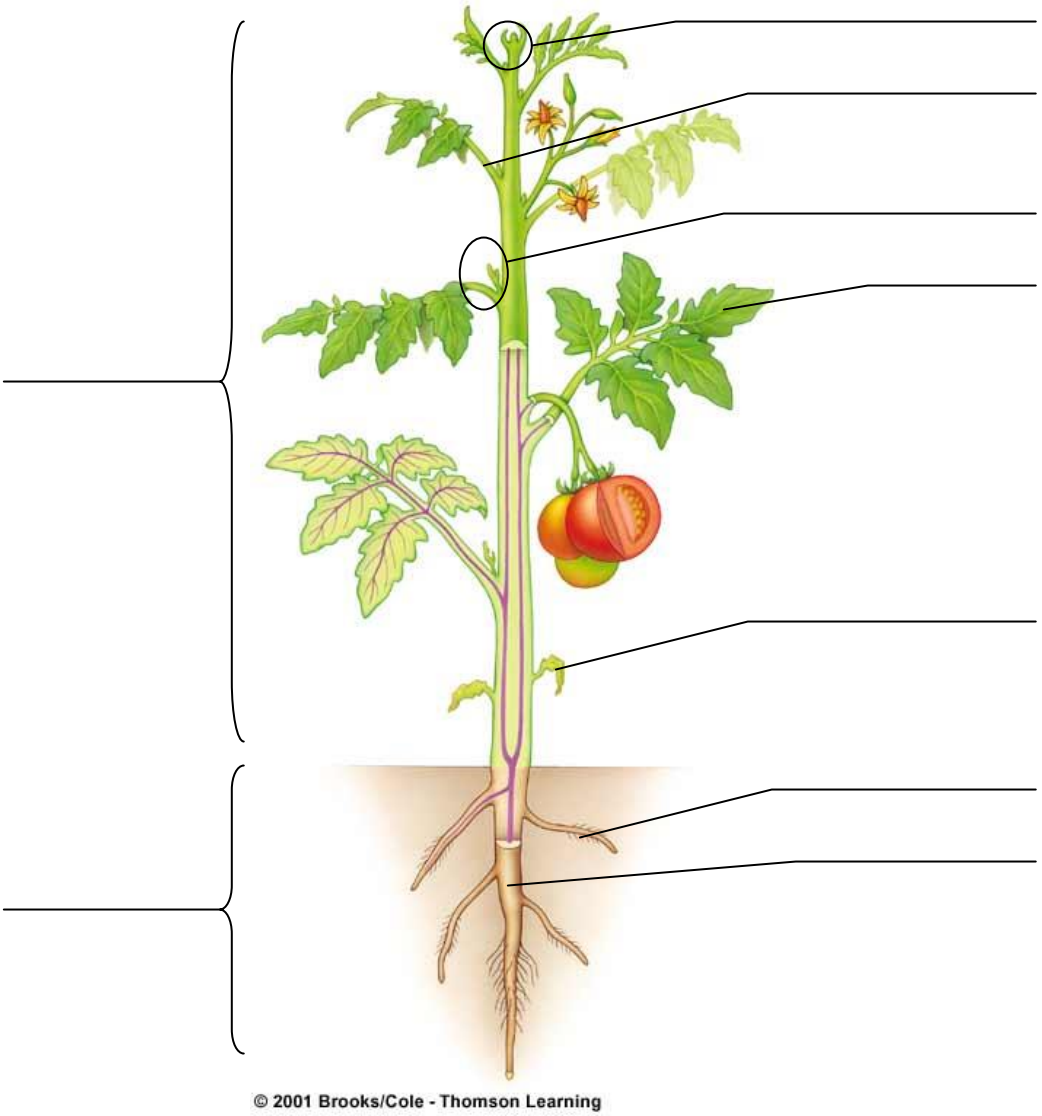
NAME: _____ DATE: _____

PARTNER: _____

PLANT ANATOMY

The principal structures of a typical seed-bearing vascular plant include a root system (the "underground" structures involved in the absorption of water and nutrients from the soil) and a shoot system (the "above ground" portion that includes stems, leaves, flowers & fruits). In this laboratory session, we will explore many of these structures and review their basic functions. To begin this session, use your text to familiarize yourself with the general structures of plants. Use the list of terms below to identify the structures indicated on the diagram.

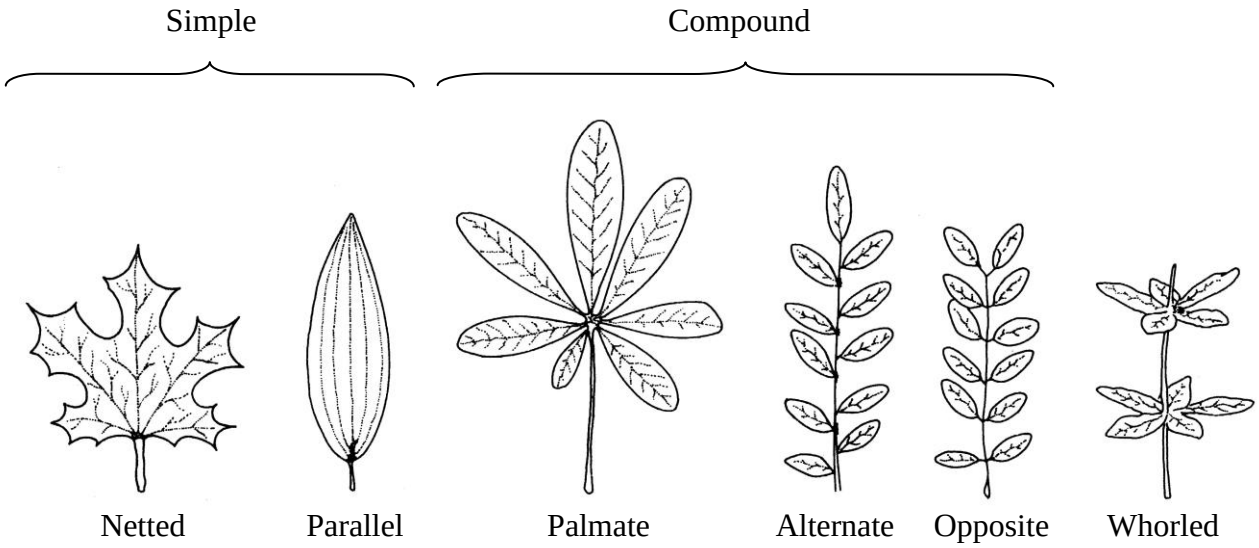


a. blade
b. cotyledon
c. lateral bud
d. lateral root
e. petiole
f. primary root
g. root system
h. shoot system
i. terminal bud

I. LEAVES

In this section you will examine variation in the external features of leaves. In terms of their method of attachment, leaves can be petiolate (petiole attaches leaf to stem) or sessile (leaf lacks petiole and attaches by a sheath). Petiolate arrangements may give rise to simple leaves (one leaf per petiole) or compound leaves (several leaflets share one petiole). The veins of leaves may show patterns as well: netted (veins that branch) and parallel (parallel veins that extend the entire length of the leaf. The last characteristic we will examine shows patterns of leaf arrangement along a stem (phyllotaxis). This can be alternate (alternate one leaf per node), opposite (two leaves per node on opposite sides of the stem) and whorled (more than two leaves per node).

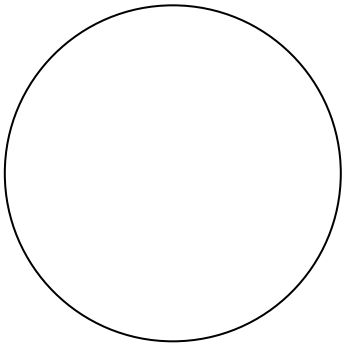
A. Categorizing Leaves



Specimen	Leaf Type (simple or compound)	Veination (netted or parallel)	Leaf or Leaflet Arrangement (alternate, opposite or whorled)
1			
2			
3			
4			
5			
6			

B. Epidermal Structures of Leaves

1. Use a dissection microscope to examine the underside of one of the leaves from the Wandering Jew (*Zebrina pendula*). Note the numerous stomata (the guard cells appear green amongst the purple epidermis of the leaf). The best viewing is obtained using just the base light of the microscope.
   a. Draw a representation of what you observe under the microscope. Label the stomata.



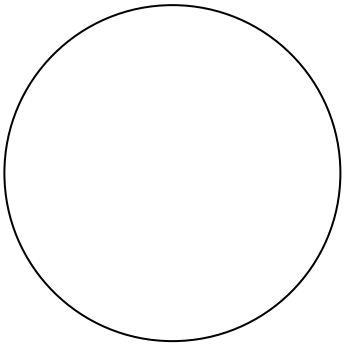
   b. What is the function of stomata in the processes of…
      - photosynthesis? _____
      - transpiration? _____

   c. Now, compare the number of stomata you see on the upper surface of the leaf to what you see on the lower surface. How do these compare? How might this be important in terms of the water conservation needs of the plant?

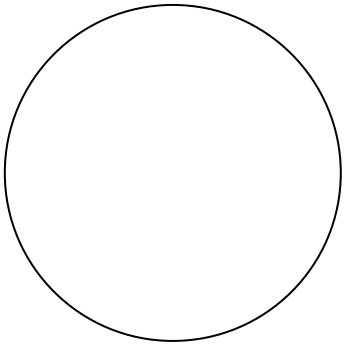
II. STEMS & ROOTS

Xylem and phloem, the vascular tissue of angiosperms, are arranged differently in monocots vs. dicots, and differently in stems vs. roots. Use your text for reference.

1. Using prepared slides at microscope stations, observe cross-sections of stems of dicots versus monocots. Draw what you see here. Label xylem and phloem.

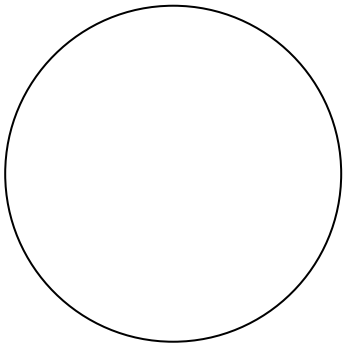


Monocot

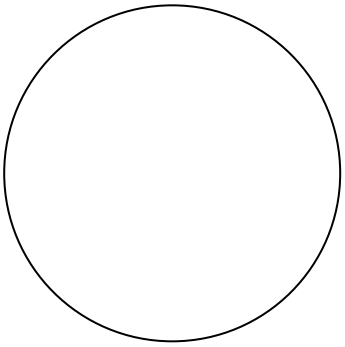


Dicot

2. Using prepared slides at microscope stations, observe cross-sections of roots of dicots versus monocots. Draw what you see here. Label xylem and phloem.



Monocot



Dicot

III. FLOWERS

Although they may not all be as obvious and brilliant as those found in a bouquet of roses, flowers are a defining characteristic of the angiosperms. These reproductive structures are the part of the sporophyte that produce the gametophytes of these plants which, after fertilization, develop into fruits and seeds (to be explored in the following section).

A. Parts of the flower

1. Obtain a cut flower. Is it a monocot or dicot? How can you tell? _____

_____

_____

2. Use your text or the figure below to identify the parts of your flower. Then state a brief summary of their functions in the spaces that follow.

   a. Stamen _____

      - Filament _____
      - Anther _____

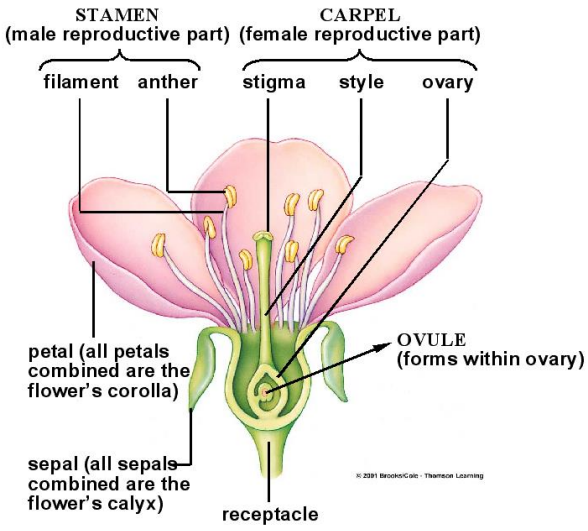
   b. Carpel _____

      - Stigma _____
      - Style _____
      - Ovary _____
      - Ovule _____

   c. Sepal _____

   d. Receptacle _____

   e. Petals (corolla) _____

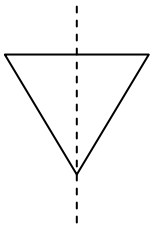


IV. SEEDS & FRUITS

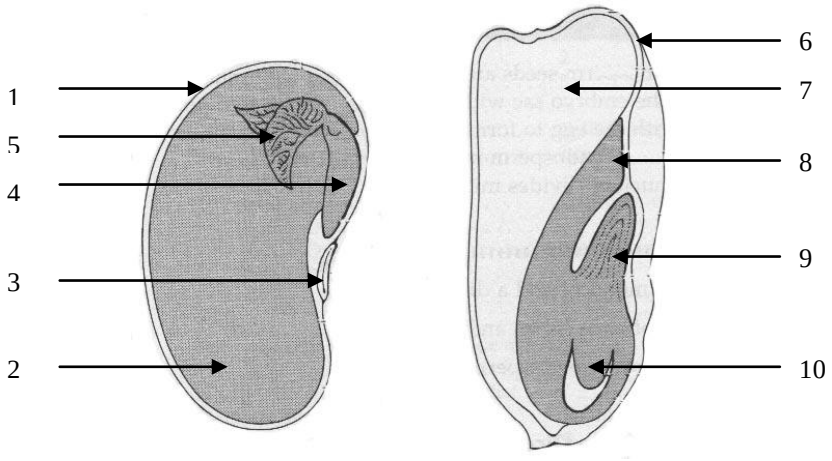
A seed can be defined as a mature ovule that includes an embryo, a food supply and a seed coat. These are released from the parent plant and develop on their own into new sporophyte plants. Fruits are the mature ovaries of angiosperms that contain the ovules from which, after fertilization, the seeds of those plants will develop. Fruits are commonly categorized as being either fleshy (where the mature fruit is moist and fleshy) or dry (where the mature fruit is fairly dry). Examples of fleshy fruits include apples, berries, tomatoes, pineapples, and melons. Examples of dry fruits include nuts, peas and beans. Fleshy fruits can also be categorized by how the fruits develop: simple fruits (develop from one ovary of one flower; e.g., grapes, cherries), aggregate fruits (develop from multiple ovaries of a single flower; e.g., raspberries, blackberries), multiple fruits (represent the combined ovaries of multiple flowers; e.g., pineapple), accessory fruits (most of the flesh derived from the receptacle; e.g., apple, pear). Use your text for reference.

A. Seeds of Dry Fruits

One of the characteristic differences between monocot and dicot plants can be seen in the structure of their seeds. Monocot seeds produce one cotyledon (seed leaf) which stores the digestive enzymes used to release nutrients from endosperm after the seed germinates (begins to grow). Dicot seeds produce two cotyledons that absorb nutrients from the endosperm prior to germination and, therefore, store nutrients in these seeds.



1. Obtain one each of the water soaked lima bean and corn seeds.
2. Note the presence of the seed coat that can easily be removed from the lima bean. In corn, the seed coat is fused with the pericarp (the thickened wall of the ovary).
3. Split each of these seeds in half to reveal the internal structures. You will need to cut the corn seed along its broadest surface with a razor blade.
4. Place the seeds under a dissecting microscope and identify the following structures:
   a. Lima bean
      1. seed coat
      2. cotyledons
      3. hilum (where the seed attached to the wall of the ovary)
      4. hypocotyl (develops into root)
      5. first leaves (true foliage leaves of the plant)
   b. Corn
      6. pericarp (outer covering)
      7. endosperm
      8. cotyledon
      9. epicotyl (develops into shoot)
      10. hypocotyl (develops into root)



5. The carbohydrates used for nourishment by the seed are stored in the form of starch (a branching polymer of glucose). A solution of iodine can be used to identify these storage areas in the seed by reacting with starch to produce a deep purple/black color.
   b. Place the seeds cut-side down in a shallow dish of iodine solution and let them sit for 10-15 seconds. Remove from the iodine, briefly rinse with water and examine.
   c. Based on this test, which area(s) of the seeds (use the proper name) store or have a high concentration of these food reserves? _____

_____

_____

A. Categorizing fruits

1. Examine the fruits on display, fill out the table and answer the questions below.

	Monocot or Dicot?	**Fleshy or Dry?**	**Simple, Aggregate, Multiple or Accessory Fruit?**
1			
2			
3			
4			
5			
6			

   a. What structure of the flower developed into the fleshy part of the apple? What structure is represented by the "leaves" extending from the "bottom" of the apple?

_____

_____

_____

_____

   b. From what flower structure(s) were the individual "lobes" of the pineapple formed?

_____

_____

_____

_____