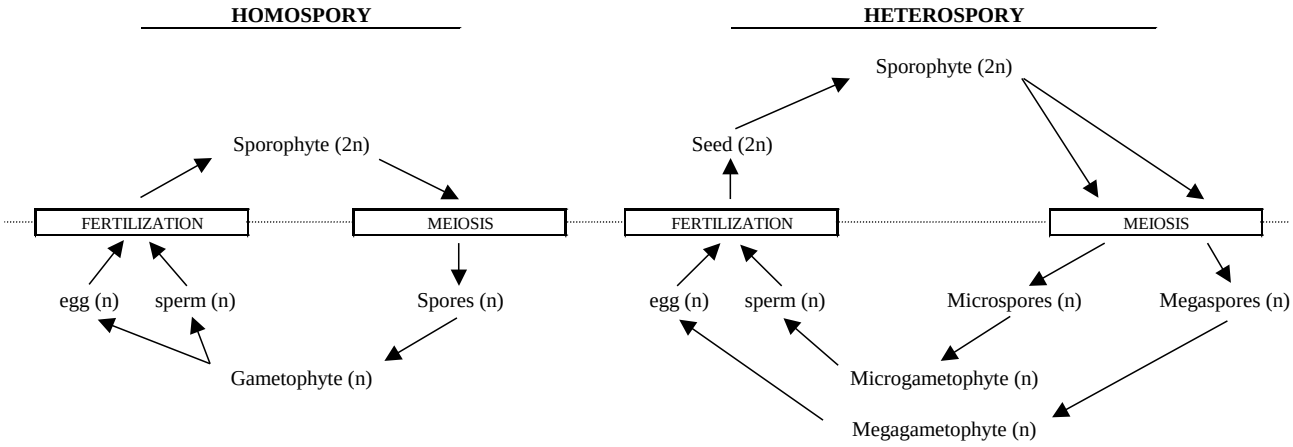
NAME: _____ DATE: _____

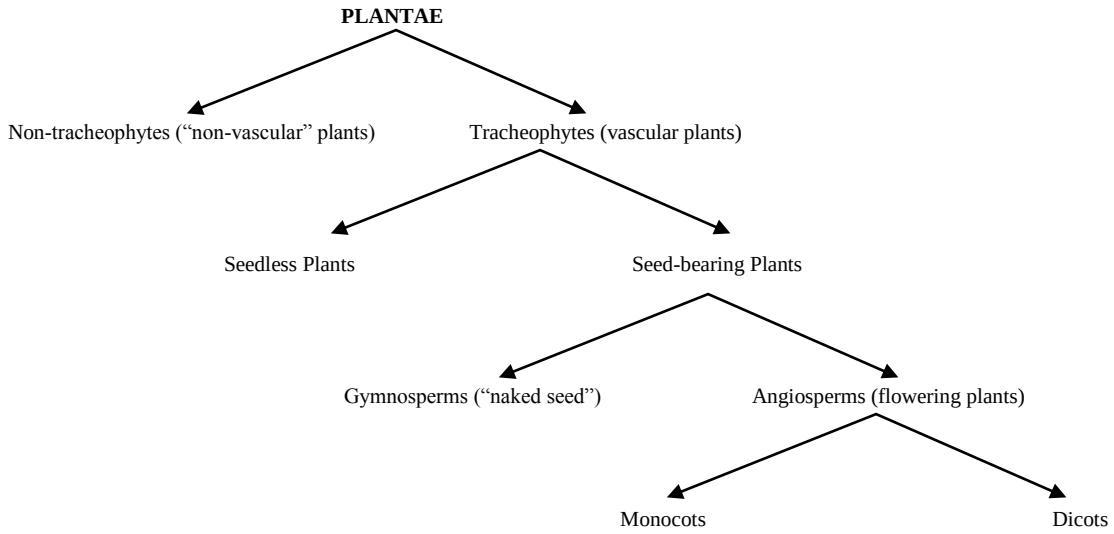
PARTNER: _____

DIVERSITY II
Plantae

In this exercise, we will explore structural and functional diversity within the plant kingdom. Some common characteristics of these organisms are that they are all multicellular photosynthetic autotrophs and their life cycles show an alteration of generations. The latter consists of a diploid (2n) sporophyte which produce diploid spores, through either a homosporus (1 kind of spore) or heterosporus (2 kinds of spores) process, that grow into haploid (n) gametophytes. The gametophytes produce haploid gametes which will combine (fertilization) and grow into a new sporophyte to complete the cycle. Generalized life cycles for homosporus and heterosporus plants are shown below.



To direct the course of our study, we will follow the common taxonomic approach depicted below as we examine characteristics of members within this kingdom.

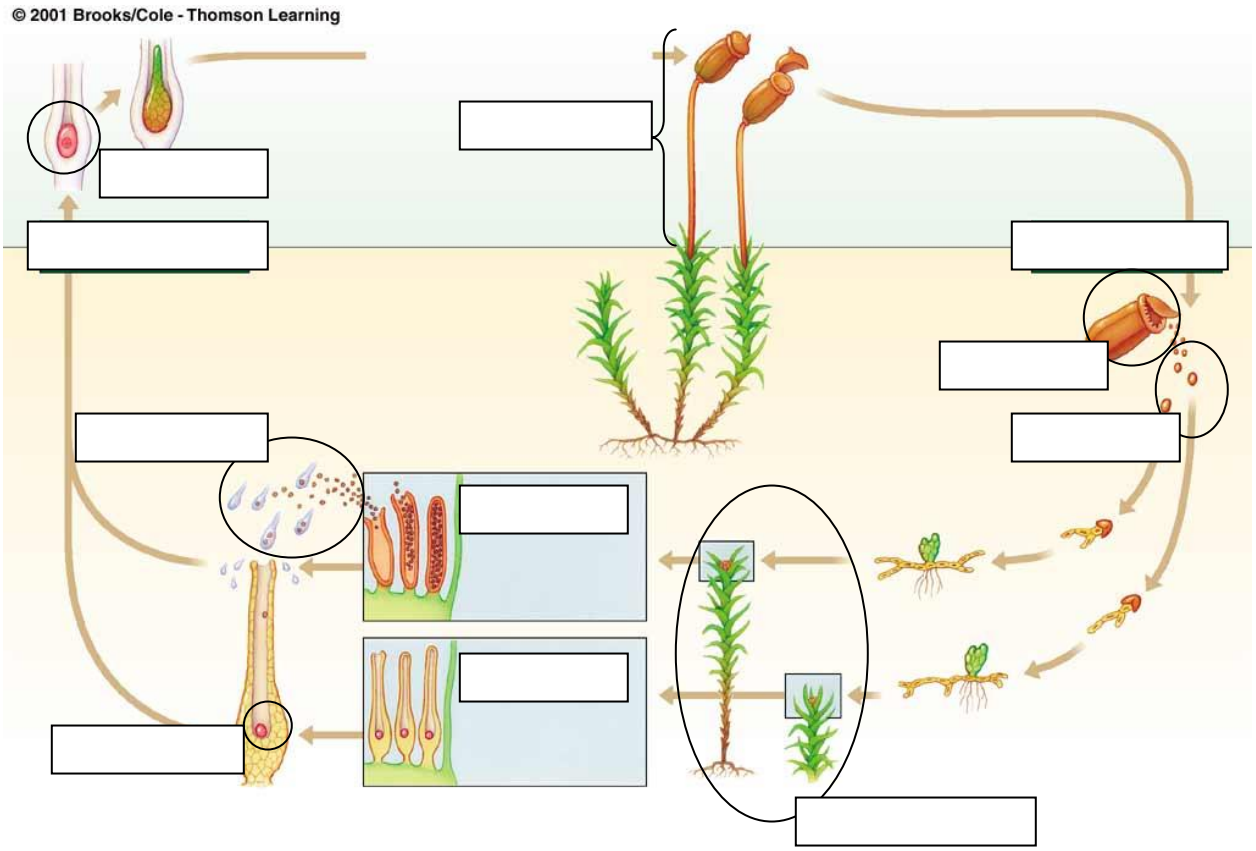


I. NON-VASCULAR PLANTS (NON-TRACHEOPHYTES)

The non-tracheophytes include the mosses, hornworts and liverworts. Although generally referred to as the "non-vascular" plants, some members, particularly the mosses, do have limited amounts of vascular tissue. The primary focus of this exercise will be to examine the anatomical structures and life cycle of the mosses.

A. Moss Life Cycle

1. Watch the video clip of the moss reproductive cycle (🎬 moss_life_cycle) at one of the computer stations.
2. Use your text as a guide to follow the moss life cycle. Fill in the blanks in the following diagram using the terms below. Note that the sperm producing structures are called antheridia, the egg producing structures are called archegonia, and the spore containing structure is called the sporangium or capsule (the end is covered by an operculum which pops off to release the spores).



Terms:

a. antheridia	e. gametophytes	i. spore
b. archegonia	f. meiosis	j. sporophytes
c. egg	g. sperm	k. zygote
d. fertilization	h. sporangium	

3. Which generation is dominant in this organism? _____
4. Which generation is diploid? _____

5. Why is the diploid nature of the sporophyte important in the overall reproductive process of plants? _____

_____

_____

_____

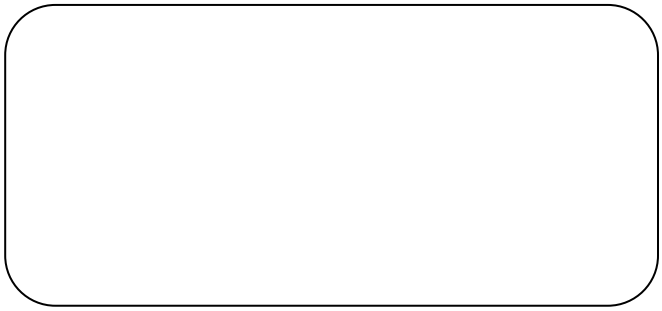
6. Why is water necessary for the moss reproductive cycle? _____

_____

_____

B. Structural Characteristics of Moss

1. Obtain a live moss sample and use a dissecting microscope to locate and identify the following structures. Draw and label them in the space provided (be neat!).
   a. sporophyte
   b. sporangium
   c. gametophyte



2. Try to differentiate the separate gametophytes in your live moss.
   a. What is one way that you can quickly identify female gametophytes?

_____

_____

II. VASCULAR PLANTS (TRACHEOPHYTES)

The true vascular plants contain highly specialized tissues for conducting water (xylem) and foods (phloem) throughout the plant and the sporophyte is the dominant stage of the life cycle. You will examine structures and life cycle patterns of various examples of these plants throughout this section. The seedless vascular plants will be examined first, followed by the two divisions of seed-bearing vascular plants: gymnosperms ("naked seed") and angiosperms ("seed vessels").

A. Seedless Vascular Plants

Common examples of vascular plants that do not produce seeds are the ferns (*Pterophyta*), whisk ferns (*Psilophyta*), club mosses (*Lycophyta*) and horsetails (*Sphenophyta*).

1. Watch the video clip of the fern reproductive cycle (fern_life_cycle) at one of the computer stations.
2. Examine the plasmount containing the club moss (*Lycopodium*) and the "live" fern frond on display.
   a. Examine the club-like structures extending from the top of the club moss. What are these structures called (you may need to reference your text)? _____

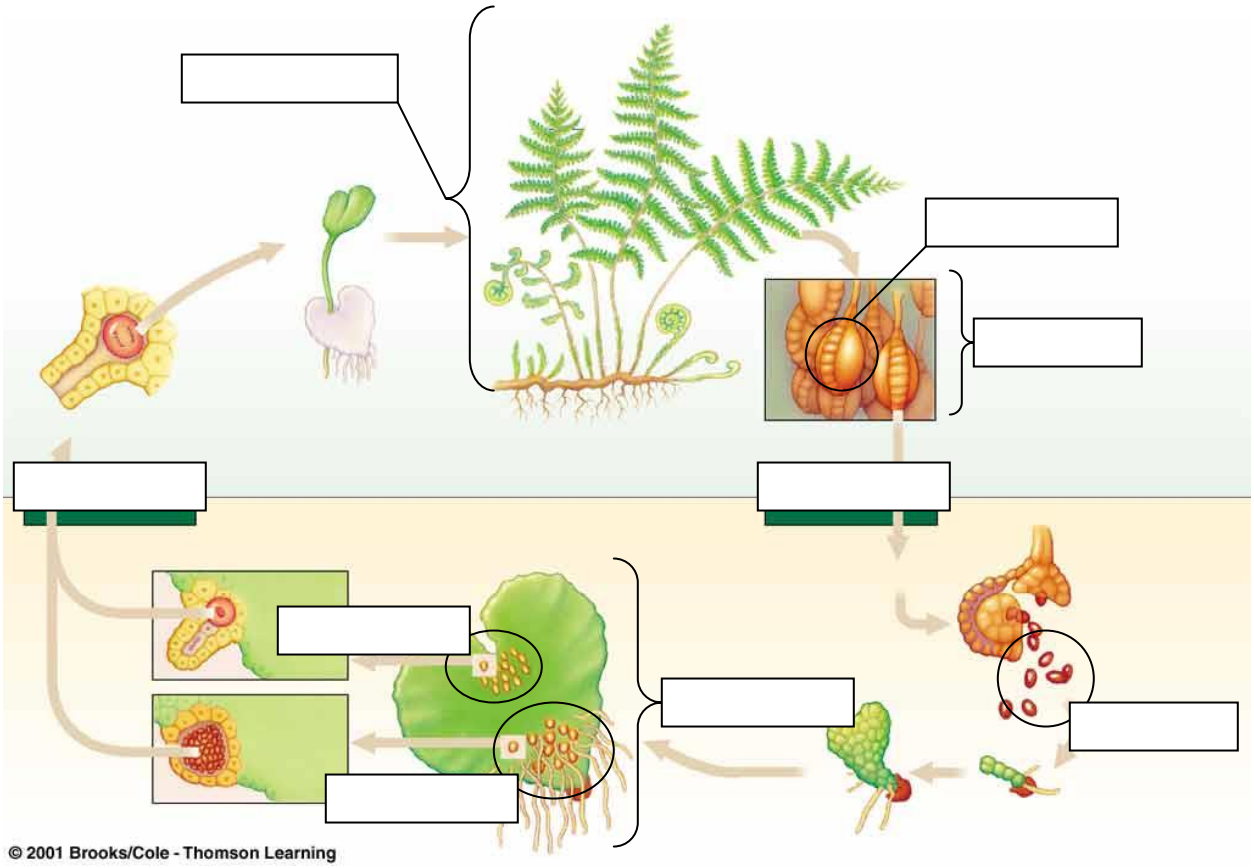
b. Examine the underside of the fern frond and then take a closer look at the leaves placed under the dissecting microscopes. Note the opened sori and the exposed sporangia within. A sorus is composed of multiple sporangia which are the actual spore producing structures. Each of these is surrounded by a special ring of cells called an annulus that is sensitive to desiccation (drying out). As the cells dry out, they change shape, open the sporangium and cause the spores within to be released.

c. What is the functional relationship between the club-like structures of the club moss and the sori of the fern? _____

_____

_____

3. Use your text as a guide to follow the fern life cycle and use the terms below to fill in the blanks. As with moss, the sperm producing structures are called antheridia, the egg producing structures are called archegonia and a single spore containing structure is a sporangium. The sporangia can be seen on the underside of fronds grouped into clusters called sori. The gametophyte is called a prothallus.



Terms:

a. antheridia
b. archegonia
c. fertilization
d. gametophyte
e. meiosis
f. sorus
g. sporangium
h. spore
i. sporophyte

a. Which generation is dominant in this organism (fern)? _____

b. Would this be considered a homosporus or heterosporus plant? Why?

_____

_____

_____

c. As the fern grows, how does the relationship between the sporophyte and gametophyte differ from that of the mosses (hint: think nutrition)? _____

_____

_____

B. Gymnosperms

The plants producing "naked seeds" get their name by the fact that the seeds rest exposed on scales and are not completely surrounded by sporophyte tissues at the time of pollination. Common examples of these plants are the conifers (*Coniferophyta*), ginkos (*Ginko biloba*) and cycads (*Cycadophyta*).

1. Watch the video clip of a gymnosperm reproductive cycle (🎬 pine_life_cycle) at one of the computer stations.
2. Examine the cones on display.
   a. Which ones are the <u>pollen</u> (male) cones? _____
   b. Which ones are the <u>ovulate</u> (female or seed-bearing) cones? _____
   c. How do the ovulate cones differ in general appearance from the pollen cones?

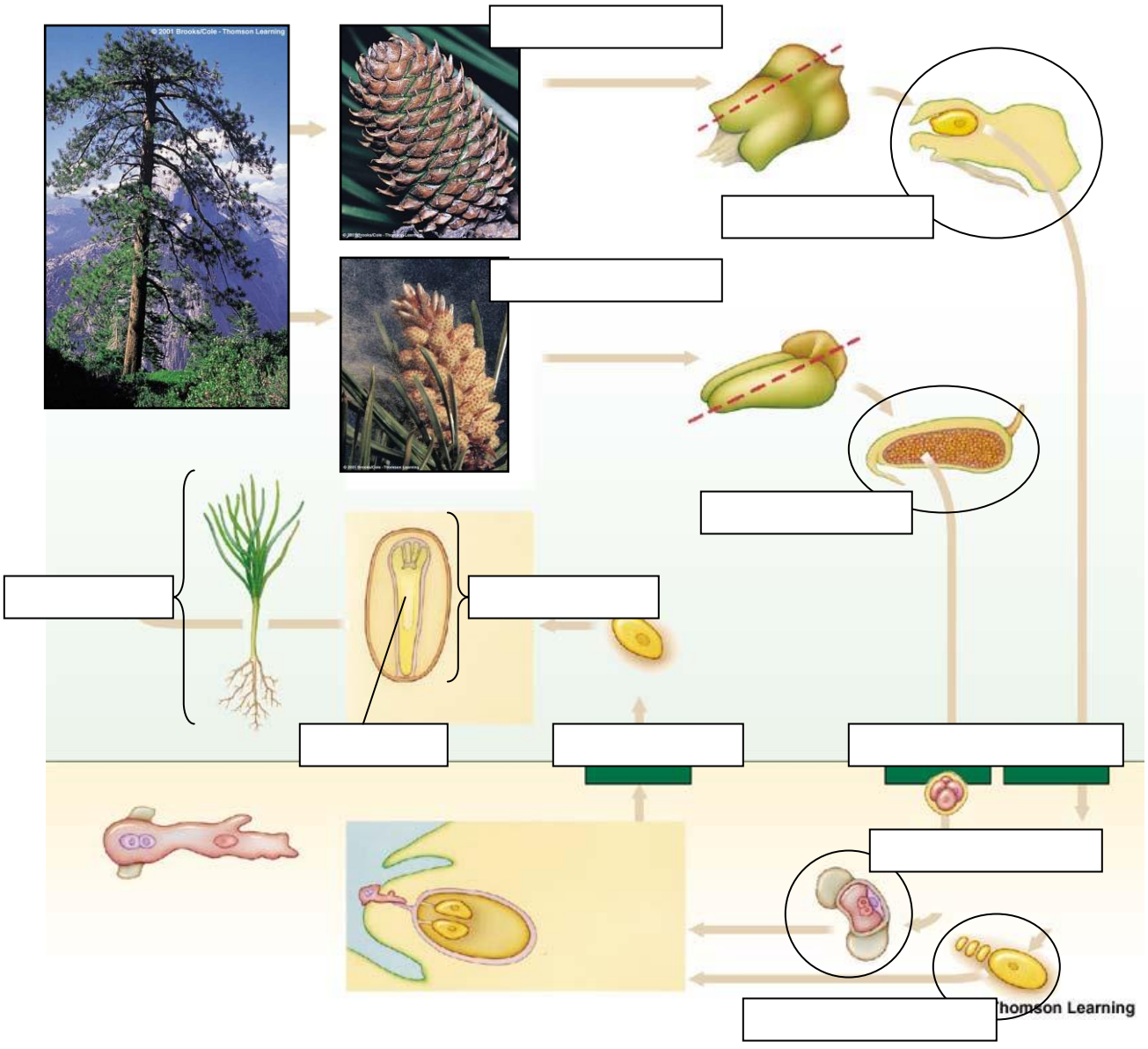
_____

_____

_____

_____

3. Using the terms below and your text as a guide, fill in the blanks of the following life cycle diagram of a typical conifer. Note that the male cones (pollen cones) contain <u>microsporangia</u> that will produce the <u>microspores</u> which develop into <u>pollen grains</u> (the male gametophyte or microgametophyte). The female cones (ovulate cones) contain <u>megasporangia</u> that produce <u>megaspores</u>. Some of the megaspores will develop into the female gametophyte (megagametophyte) which contains eggs. One of these will be fertilized and develop into a seed.



<u>Terms:</u>

a. ovulate cone
b. pollen cone
c. microsporangium
d. megasporangium
e. meiosis
f. seed
g. embryo
h. pollen grain (male gametophyte)
i. female gametophyte
j. fertilization
k. sporophyte

a. Compare seeds and spores in terms of genetic material and function.

_____

_____

_____

_____

_____

_____

_____

C. Angiosperms

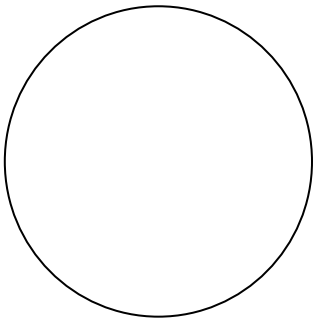
In the plants with "seed vessels", the seed is enclosed and develops within an ovary which is found within the flower. Therefore, these are commonly referred to as the flowering plants (although the "flower" may not always be recognized as such). In this exercise, you will review the general life cycle of angiosperms and initiate the germination of a pollen grain.

1. Examination and Germination of Pollen Grains.

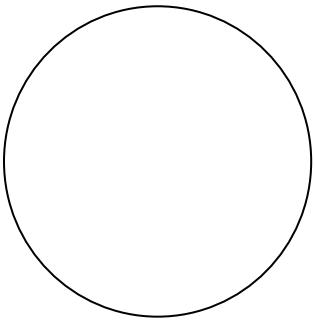
   Start this procedure near the beginning of class to allow enough time for germination.

   a. Tap the anther of a flower on the surface of a microscope slide.
   b. Add a drop of sucrose solution and a cover slip.
   c. Use a microscope to examine the slide initially and then at the end of class. Do not let the slide dry out! Add more solution if needed. Be sure to turn off the light source of the microscope when not viewing the specimen.
   d. Draw the appearance of the pollen grains before and after the exercise:

before



after



   e. What is the structure "growing" out of the pollen grain and what is its purpose?

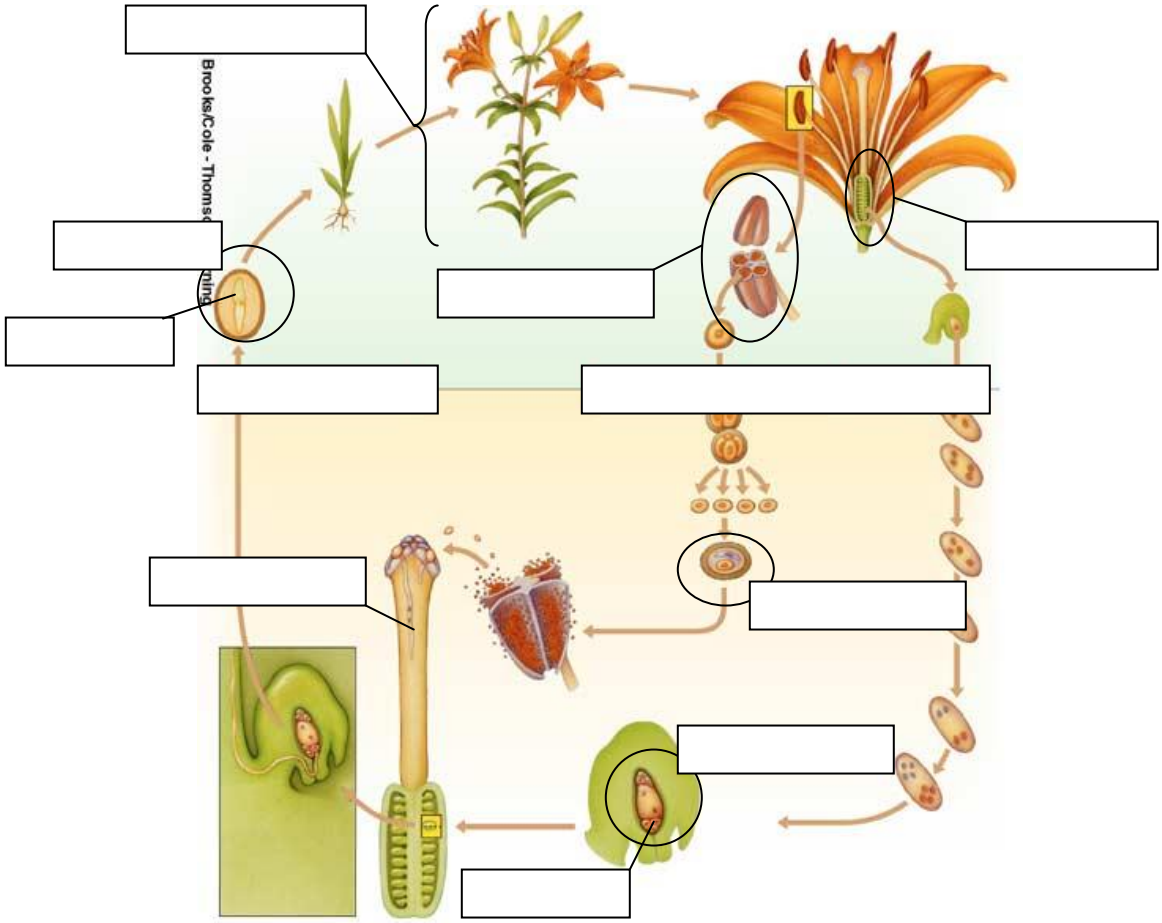
_____

_____

_____

2. Watch the video clip of an angiosperm reproductive cycle (angiosperm_cycle) at one of the computer stations.

3. Use the terms below to fill in the blanks of the following diagram depicting a typical angiosperm life cycle. Use your text as a reference.



Terms:

a. pollen sac (anther)	e. embryo	i. fertilization
b. ovary	f. pollen grain (male gametophyte)	j. pollen tube
c. meiosis	g. egg	k. sporophyte
d. seed	h. female gametophyte	

a. Like the gymnosperms, what must occur for the male gamete (sperm) of the angiosperm to reach and make contact with the female gamete (egg)? _____

_____

_____

_____

b. In the angiosperms, what characteristic of the fertilization process is distinctly different from what occurs in the gymnosperms? _____

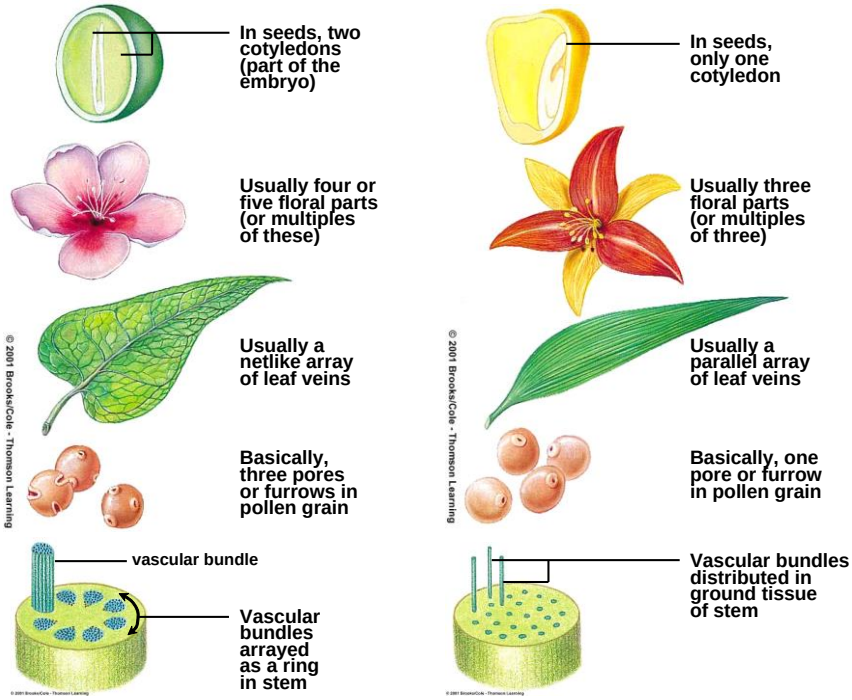
_____

_____

_____

D. Monocots & Dicots

The angiosperms can be divided into two groups based on the characteristics indicated in the figures below.



1. Examine the specimens on display and determine if they are of monocots or dicots. Explain how you came to these conclusions.

Specimen	Monocot or Dicot and Why?
1	
2	
3	
4	
5	
6	