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1. Certain fungi produce a chemical that stimulates the activity of the plasma membrane proton-ATPase of plants. Predict and explain the effect of this chemical on each of the following processes in a plant (10 pts. total)

a. Stem cell elongation

15 Stimulating  $H^+$ ATPase would increase cell elongation b/c  $H^+$ ATPase makes the cell wall solution more acidic, which activates the enzymes that break down the matrix and cellulose of the cell wall. <sup>f2</sup>

b. Stomate opening

14 More  $H^+$ ATPase would cause the stomates to open or stay open, because  $H^+$ ATPase is what ultimately causing an increase in solute concentration, which leads to water diffusing into the guard cells, causing them to swell and open the stomate. <sup>f2</sup>

2. You are trying to find cucumber plants that have a mutation that causes phytochrome to remain in its PFR form. You treat seeds with an agent that causes mutations. Then you plant the seeds. (12 pts total)

a. Describe a set of conditions, under which you could grow the seedlings, that would allow you to pick out the plants with the desired mutation.

5 Grow the seedlings in Red light only so the normal seeds could not be converted back to Pr form. The seeds that germinate are the mutants.

- b. List 2 characteristics that would allow you to distinguish between normal plants and those with the mutation. Be sure to describe what both the mutant and the normal plants would look like for each characteristic.

Characteristic	Appearance	
	Plants with mutation	Normal plants
1. Leaf expansion	increased	unchanged
2. Apical hook	Straight	not straight

## 10. Matching: (2 pts. per blank; pts. 20 pts. total)

Put the number corresponding to the correct answer on the line to the left of the definition. **Note:** There may be more than one correct answer, but put **only one** number on each line. You may use a number more than one time. **Caution:** write number clearly; ambiguous numbers will be marked wrong.

- |                       |                        |   |
|-----------------------|------------------------|---|
| 1. $\text{Ca}^{2+}$   | 9. ginger              | 17. <i>Rhizobium</i> /Legume association  |
| 2. $\text{SO}_4^{2-}$ | 10. carrot             | 18. Mycorrhizal association               |
| 3. $\text{NH}_4^+$    | 11. onion              | 19. Red alder/ <i>Frankia</i> association |
| 4. $\text{NO}_3^-$    | 12. orchid             | 20. cuticle                               |
| 5. one                | 13. subapical meristem | 21. Casparian strip                       |
| 6. two                | 14. apical meristem    | 22. cotyledon                             |
| 7. three              | 15. pericycle          | 23. coleoptile                            |
| 8. potato             | 16. insectivory        | 24. endosperm                             |

- 1 Ion that may be bound to clay particles
- 11 Plant with underground, food-storing leaves
- 10 Plant with underground food-storing roots
- 18 A mutualistic relationship that enhances water uptake by plant roots
- 15 A meristem found in roots but NOT in stems
- 20 Waxy layer that slows water loss in leaves
- 21 Waxy layer that helps regulate movement of solutes across roots
- 6 Number of cotyledons in a peanut embryo
- 22 Location of stored food in a peanut seed
- 23 Location of stored food in a grass seed

(4)

7. You have been allowing your horse to graze on your front lawn. The horse urinates six liters of urine (pH 8.2) onto the lawn. What do you predict will happen to the grass where the urine landed? Explain the physiological basis for your prediction. (8 pts.)

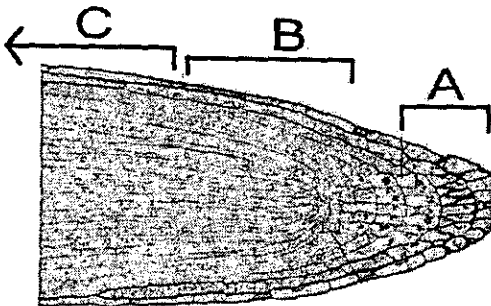
4  
Being above a pH of 7, the urine is basic. This means that it will cause a reaction in which it uses other ions to precipitate and takes away these ions from the grass, so the grass has a mineral deficiency

8. Fill in the answers to these questions. (12 pts. total)

a. Two functions of the leaves of the Pitcher Plants that you saw on your Greenhouse Tour	2 2	1. photosynthesis 2. catch bugs
b. Function of the aleurone layer in seeds of the Grass family	2	produces/releases enzymes that digest endosperm
c. One adaptation of an epiphyte for getting and/or conserving water (you don't have to give the name of a specific plant)	2	white leaves allow epiphytes to reflect light instead of absorbing heat, which decreases transpiration
d. Source of carbon for root cells (name of a molecule)	0	CO <sub>2</sub>
e. Tissue in which the source you named above (d) enters the root	2	vascular tissue -phloem

98. Fill in the blanks. (6 pts.)

- 2
- a. What is shown in the picture below Apical bud
- b. What is the function of the region labeled "A"? production of new organs
- c. Letter corresponding to the region of division growth B 2

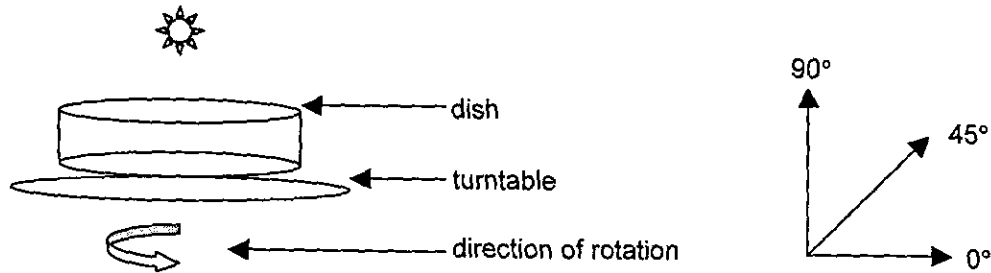


16

(3)

6. Answer ONE of the following 2 questions. If you answer both questions, only your first answer will be graded. (10 pts)

A researcher planted oat seeds in a cylindrical dish with appropriate levels of water, overhead light and nutrients. This dish was then mounted horizontally on a rotating turntable (see below). What do you predict the orientation of the roots and shoots will be (in degrees)? Why?

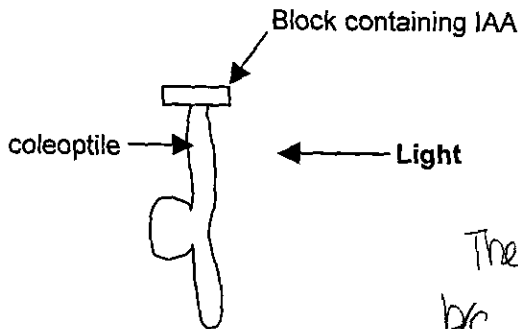


Predicted Root Orientation (degrees) \_\_\_\_\_ Predicted Shoot Orientation (degrees) \_\_\_\_\_

Explanation of Prediction:

\*\*\*\*\*OR\*\*\*\*\*

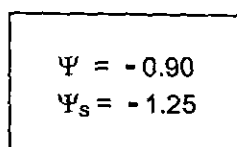
You are studying phototropism in Corn coleoptiles. You do the following experiment. You cut off the tip of the coleoptile and replace it with a block of agar containing IAA. You then place the coleoptile in unilateral light (see below). Which direction will the coleoptile grow? Explain why this will happen.



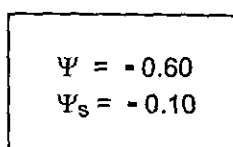
in tip → The coleoptile will grow ~~towards~~ the light, b/c the IAA will sense the light w/ a photoreceptor (phototropin) and move to the dark side. Since more IAA will be on the dark side, these cells will elongate faster and cause the coleoptile to bend towards the light

(2)

3. Below are two cells in a plant; long distance transport of water is occurring in this plant. One cell is a vessel element and the other is parenchyma cell that is near the vessel element. (8 pts total)



Cell A



Cell B

A  
 $-0.90 = \Psi_p - 1.25$   
 $\Psi_p = .35$   
turgid

B  
 $-0.60 = \Psi_p - 0.10$   
 $\Psi_p = -.50$   
not turgid

- a. Which cell is the vessel element. Explain your choice. **+2**

The vessel element is cell B, because vessel elements are dead and have no plasma membrane. Therefore, they are not turgid (but rely on their secondary wall for support). Parenchyma cells do have a plasma membrane, however, and must have a  $\Psi_p > 0$  in order to carry out long-distance transport.

- b. Are these two cells located in the root or in a leaf? Explain how you can tell? **+1**

These cells are located in the leaf because they have such a low  $\Psi$ . Leaves must have a lower  $\Psi$  than roots in order for water to flow from root  $\rightarrow$  leaf. **See key**

4. You took home the *Coleus* cutting that you got in Bio 220 class and put it in water. As soon as it produced some roots, you planted it in soil in a pot. You put it in front of a window to grow. For about a week, you notice that the leaves of the new plant wilt only during the day even though the soil is well watered. After a week, the leaves remain turgid during the day as well as at night. (8 pts.)

- a. Why did the leaves of the new *Coleus* plant wilt?

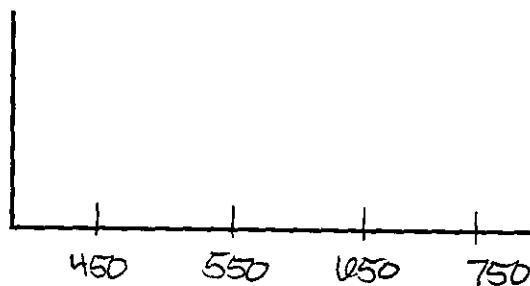
The leaves wilted b/c the young plant's roots weren't developed enough to be able to resupply the plant with water as fast as it was lost during transpiration, which means the plant lost turgor pressure.

- b. Describe one thing that you could have done to keep the leaves from wilting and explain why that treatment works. (Note: the treatment should not kill the plant).

You could take the plant out of the direct light of the sun during mid-day, which would decrease the transpiration rate and allow resupply of H<sub>2</sub>O from the roots to keep up and maintain turgor pressure. How?

5. You have discovered a plant that produces a red pigment in its stem when it is grown in the light, but produces no red pigment in the dark. You would like to know what the photoreceptor for this response is. You do an experiment to determine the action spectrum for this response. Your lab partner drew the axes for the graph of your results, but has forgotten to label them. Fill in the labels for the axes of the graph. (6 pts.)

amount of red pigment produced



wavelength (nm)