Plant Organismal Biology
Exam 1 Questions/Study Guide

Note: some editing has occurred. Some questions have been combined.

One of the following eight questions will appear on your midterm. One picked by the class...one picked by my dog Dudley.

1. Cell walls of plants play an important role in structure and cellular functions, describe the cell walls of cells within the vascular bundle (phloem, xylem, etc) and how each specific type of cell wall benefits the cell for its specific purpose.
2. How do the xylem and phloem work together to transport water/sugars?
3. What are the benefits for a plant in having a lateral root? How and where is it formed and what is its primary structure?
4. What's up with this Acid-Growth Hypothesis?
5. Tree Trunks shrink during the day. Why is that? How does that effect the volume flow rate equation?
6. Roots and shoots of plants exhibit phenotypic plasticity. Give one example for each plant organ that illustrates how the plant responds to changing environmental conditions and why it may do so.
7. Describe apoplast, symplast, and the Casparian strip and how all three are related.
8. What is the importance of the cytoskeleton in plant cell division, and cell growth and differentiation?

Study Resource...

9. Compare and contrast the pressure-flow hypothesis and the cohesion-tension theory.
10. What would be the consequences for a plant that did not have microfibrils?
11. Explain why the oleander plant from Southern Eurasia has leaves on which stomata exist only on the underside of leaves. Explain it in relation to the photosynthesis-transpiration compromise, and what that means. Also explain the structure of a stoma, and describe at least 3 functions the stoma has in a plant.
12. What is the casparian strip and what is it's significance in regard to transport?
13. Describe the Water Uptake By Roots and the upward movement of water within a plant how it works.
14. What would be the consequences for a plant that was lacking this?
15. Discuss aquaporins as a transmembrane protein and how they might function in plant growth and development.
16. Compare and contrast the structure and function of the Root Apical Meristem and the Shoot Apical Meristem (include all primary growth). How are these similar and how do they differ?
17. Describe the acid growth hypothesis and how it affects turgor pressure. Is this active or passive transport?
18. What are the three different cell types that compose ground tissue and what are their functions? Which are functional at maturity?
19. Consider a dicot plant that can only be found in moist and shady environments. With your knowledge of specific structural components and processes of such a plant, describe how this plant would need to change if the climate suddenly underwent a several year long drought and water was limited. How would the effects be different if the plant was in the same environment but was solely exposed to more direct sunlight during the day. You should be able to include your knowledge of the following differences between plants in dry/wet; sunny/shady environments in your response. In your response please include at least two of the following
notes. 1. photosynthetic processes 2. water uptake and transportation 3. plant structure and its influence on water and mineral transportation, as well as 4. Properties of water 5. possible consequences of an immediate shift in climate environmen

20. Name two different apical meristems and two different lateral meristems. Describe the function of the four meristems.

21. Recalling what you know about xylem and phloem, explain if it would be possible for xylem to transport sugars/carbohydrates and phloem to transport water without making any other changes to their structure and function. Don’t forget to support your reasoning.

22. An individual plant cell is small and unseen to the naked eye. However, a tree root can have enough power to lift and crack a several hundred pound piece of sidewalk. With your knowledge of plants, propose a way in which the roots can manage to lift the sidewalk.

23. Describe where xylem and phloem are found in the plant, and how they experience primary and secondary growth. In addition, discuss what cells compose these structures, and any special characteristics of these cells. Finally, discuss the importance of these structures in a plant, and how they transport vital fluids through the plant.

24. Explain the cohesion-tension theory and how it applies to a plant so that water can reach all areas of the plant. Use concepts/terms including water potential, transpiration, and xylem.

25. What type of cells dominate the body of a woody plant? Why? Where do they come from?

26. Compare and contrast two hypotheses for how water can be transported up a plant.

27. Large trees have the ability to move water from their roots to their leaves. Describe the process and how water potential drives this mechanism.

28. Describe how root pressure, diffusion and bulk flow transport water and give an example of where each one is used.

Describe the difference between a plant living in harsh conditions (desert, tundra) to a giant tree living in a forest. How do they both grow and survive?

List and describe the three distinct cell types found in ground tissue.

29. What are tracheids and vessel elements and how do they differ?

30. Describe the three theories of how water moves from roots to shoots, and name which one is thought to explain the ability of water to move several meters vertically in a vascular plan as well as why the other two theories could not explain such movement.

31. Explain the specific properties and forces in which water is able to defy gravity and be transported up a stem without exerting any ATP.

32. What are the three major tissue types that come from primary growth and what are their functions?

How does the Cohesion-Tension theory describe the movement of water in plants?

33. Explain the concept of turgor pressure and it's relationship with osmosis? What would happen if plant cells didn’t have turgor pressure?

34. How do parenchyma cells offer the possibility of plant cloning?

35. How does the surrounding humidity level affect the process/rate of transpiration?

36. Why do phloem cells lack secondary cell walls? Why is this characteristic crucial to phloem translocation?

37. It is a fine Spring day and you see how the new leaves are emerging from their buds. The start out wrapped around one another and then unfurl. Explain how this can happen.

38. You just finished watching James Cameron’s ’Avatar’ movie about life on the alien moon ‘Pandora’. After the movie you have dinner with your friends who saw the movie with you and just love plants. With them you excitedly talk about naming the new species on that world. What kind of structures and features from Earth plants would you use as a basis for comparison?