Cheat Sheet

Chapter 36 Questions

1. **What is *Populus tremuloides*?**
2. **What is *Crassula connata*?**
3. **What is *Raphia regalis*?**
4. **What is phyllotaxy?**
5. **What are the 3 types of phyllotaxy?**
6. **Describe the phyllotaxy of angiosperms.**
7. **What is self-pruning?**
8. **What is the leaf-area index?**
9. **What are the differences between horizontally and vertically oriented leaves?**
10. **What is *Buchloe dactyloides*?**
11. **What is the apoplast?**
12. **What is the symplast?**
13. **What is the apoplastic route?**
14. **What is the symplastic route?**
15. **What is the transmembrane route?**
16. **How does the generation of membrane potential in plants differ from that in animals?**
17. **How does phloem absorb neutral solutes?**
18. **How do root cells uptake nitrate?**
19. **How do electrical signals in plants differ from action potentials in animals?**
20. **What is osmosis?**
21. **What is water potential?**
22. **What is the internal pressure of a living plant cell due to osmotic uptake of water?**
23. **What is the equation for water potential?**
24. **What is the protoplast?**
25. **What is turgor pressure?**
26. **What does flaccid mean?**
27. **What is plasmolysis?**
28. **What does turgid mean?**
29. **What is wilting?**
30. **What are aquaporins?**
31. **What is bulk flow?**
32. **What structures facilitate movement of nutrients between cells in vasculature?**
33. **What is the endodermis?**
34. **Describe the flow of minerals into the vascular cylinder.**
35. **What is xylem sap?**
36. **How quickly is xylem sap transported in trees with wide vessel elements?**
37. **What is transpiration?**
38. **What is root pressure?**
39. **What is guttation?**

40. What is the cohesion-tension hypothesis?
41. How is negative pressure generated?
42. What is cavitation?
43. What percent of lost water in plants is through stomata?
44. How do guard cells open and close?
45. What 3 cues contribute to stomatal opening at dawn?
46. What is abscisic acid (ABA)?
47. What makes water availability a major determinant of plant productivity?
48. What are xerophytes?
49. What are crypts?
50. What is translocation?
51. What is phloem sap?
52. What is a sugar source?
53. What is a sugar sink?
54. What direction does sugar flow?
55. How is sugar loaded into sieve-tube elements?
56. How is sugar loaded into sieve-tube elements in maize?
57. How fast can phloem sap flow?
58. What is pressure flow?
59. What is self-thinning?
60. What can cause plasmodesmata to open, close, or be eliminated?
61. What are symplastic domains?
62. What is *Mimosa pudica* and *Dionaea muscipula*?
63. How does the phloem serve a nerve-like function?

Chapter 36 Answers

1. Aspen, petiole is flattened along sides, allows for flopping (increases photosynthetic productivity
2. pygmyweed
3. Native African palm tree
4. Arrangement of leaves on a stem
5. Alternate/spiral - one leaf per node
   opposite - two leaves
   whorled - more than two leaves
6. Alternate, each successive leaf is 137.5^{o} from site of previous, minimizes shading of lower leaves
7. When nonproductive leaves/branches undergo programmed cell death and are shed
8. Ratio of total upper leaf surface of plant or crop divided by surface area of the land on which the plant/crop grows. Value of up to 7 common for crops, little agricultural benefit to higher indexes
9. Capture sunlight more effectively in low-light conditions, in sunny regions may expose upper leaves to overly intense light
   Light penetrates more deeply in plant, no leaf receives too much light
10. Buffalo grass, develop fewer roots in presence of same plant (cuttings)
11. Everything external to the plasma membranes of living cells, includes parts of dead cells such as vessel elements and tracheids
12. Entire mass of cytosol of all living cells and their plasmodesmata
13. Water and solutes move along continuum of cell walls and extracellular spaces
14. Water and solutes move along continuum of cytosol, requires substances to cross a plasma membrane to enter plant
15. Water/solutes move out of one cell, across cell wall, into neighboring cell
16. Plants mainly pump H^+ by proton pumps (typically cotransported), animals by sodium-potassium pumps pumping Na^+ (typically cotransported)
17. H^+/sucrose cotransporter couples movement of sucrose against concentration gradient with movement of H^+ down its electrochemical gradient
18. Cotransport with H^+ (used for many ions)
19. Much slower, use Ca^{2+} activated anion channels rather than sodium ion channels
20. Diffusion of free water
21. Includes the effects of solute concentration and physical pressure, predicts direction of water flow (abbr. by psi, ψ), measured in megapascals, by defn is 0 MPa = ψ in pure water in open container under standard conditions.
22. 0.5 MPa
23. $\psi = \psi_S + \psi_P$. ψ_S is solute potential (osmotic potential), directly proportional to molarity, in pure water equals 0, increased molarity decreased solute potential, 0.1 M solution of sugar has -0.23 MPa. ψ_P is pressure potential, physical pressure on solution

(positive/negative relative to atmospheric pressure), usually positive in living cells, negative (less than -2 MPa) in non living xylem cells

24. Living part of cell including plasma membrane
25. Created when protoplast presses against cell wall.
26. limp
27. When protoplast shrinks and pulls away from cell wall
28. Walled cell with greater solute concentration than its surrounding, very firm
29. When leaves and stems droop as a result of cells losing water/turgor pressure
30. Transport proteins, facilitate transport of water molecules across plasma membrane (permeability decreased by increases in cytosolic Ca^{2+} or decreases in cytosolic pH)
31. Movement of liquid in response to pressure gradient, used for long distance transport
32. Perforation plates at ends of vessel elements (sieve plates for sieve tubes)
33. Innermost layer of cells in the root cortex, last checkpoint for the selective passage of minerals from the cortex into the vascular cylinder
34. Minerals already in symplast continue through plasmodesmata of endodermal cells and pass into vascular cylinder, already screened by plasma membrane they entered through Minerals that reach endodermis via apoplast encounter dead end (Casparian strip, belt made of suberin). Water/minerals cannot cross the endodermis via apoplast, must cross plasma membrane of endodermal cell
35. Water/minerals in xylem, transported by bulk flow to veins
36. 15 to 45 m/hr
37. Loss of water vapor from leaves/aerial parts of plant
38. Push of xylem sap generated by water flowing in from cortex due to accumulation of minerals in vascular cylinder
39. Exudation of water droplets that can be seen in the morning on the edges of plant leaves (not dew), results when root pressure causes more water to enter the leaves than is transpired
40. Transpiration provides pull for ascent of xylem sap (cohesion of water molecules transmits pull along entire length of xylem)
41. Cell wall of mesophyll cells act like very thin capillary network (water adheres to cellulose microfibrils. As water evaporates, air-water interface retreats farther into cell wall. Curvature of interface induces tension, causing water molecules from other parts of the leaf to be pulled in to reduce the tension, pulling forces transferred to xylem because each water molecule is cohesively bound to next by hydrogen bonds
42. Formation of water vapor pocket, breaks chain, air bubbles expand and block water channels of xylem, not always permanent, can be repaired by transferring water from phloem to xylem
43. 95%
44. Take up water from neighboring cells by osmosis to become turgid, cell walls are uneven in thickness and cellulose microfibrils are oriented in a direction that causes guard cells to open when turgid in most angiosperm species. When cells lose water, pore closes (flaccid). Changes in turgor pressure results from absorption/loss of K^+ (open when cells

accumulate K^+ from neighbors, flow of K^+ coupled with proton pumps). Water and K^+ are stored in the vacuole, membrane of vacuole regulates guard cell dynamics

45. Light - stimulates cells to accumulate K^+, blue-light receptors in plasma membrane stimulated, in turn stimulates proton pumps
    Depletion of CO_2 - stomata progressively opens as CO_2 is depleted
    Internal clock (circadian rhythms are cycles with intervals of 24 hours)
46. Hormone produced in roots and leaves in response to water deficiency, signals guard cells to close stomata, reduces wilting but slows photosynthesis. This hormone directly inhibits photosynthesis
47. Allows plants to keep stomata open and take up more CO_2
48. Plants adapted to arid environments, many avoid drying by completing life cycles during rainy seasons
49. Recessed cavities where stomata are located in Oleander (a type of xenophyte, protects stomata from hot, dry wind)
50. Transport of products of photosynthesis, carried out by phloem
51. Aqueous solution that flows through sieve tubes, mostly have sugar (typically sucrose, concentration as high as 30% by weight), may contain amino acids, hormones, minerals
52. Plant organ that is a net producer of sugar by photosynthesis or by breakdown of starch
53. Organ that is a net consumer or depository of sugar
54. Sinks usually receive sugar from nearest sources, direction depends on location of source and sink that are connected by tube
55. Moves from mesophyll cells to sieve-tube elements via symplast or by symplastic and apoplastic pathways
56. Sucrose diffuses through symplast from mesophyll cells into small veins, sugar then moves into apoplast and is accumulated by sieve tube elements by companion cells (have ingrowths that enhance solute transfer between apoplast and symplast) or sieve tube elements
57. 1 m/hr
58. Bulk flow driven by by positive pressure, powers phloem sap movements
59. Plant might abort some sugar sinks
60. Turgor pressure, cytosolic Ca^{2+}, or cytosolic pH. Can form after cytokinesis, can lose function during differentiation (leaf maturation causes plasmodesmata to close or be eliminated). Viruses produces viral movement proteins that cause plasmodesmata to dilate. Plants regulate plasmodesmata as part of communication network
61. Groups of cells/tissues with high degree of cytosolic interconnectedness
62. sensitive plant and Venus flytrap
63. ALlows for electrical communication between widely separated organs