Transport in plants summary questions

1. What special cell makes up the epidermis of the root?
   The root hair cell

2. Which is the larger vessel in the root; the xylem or phloem?
   Xylem

3. What type of cells are found between the epidermis and the steele in the root?
   Undifferentiated / cortex cells

4. What is the main type of cell in the xylem?
   Xylem vessel

5. How does a xylem cell differ from a normal plant cell?
   No end wall, no cell contents, have secondary cell walls made of lignin

6. Which shapes of lignification characterises the protoxylem?
   Annular and spiral

7. What about the metaxylem?
   Pitted and reticulated

8. What are the main cells in the phloem called?
   Sieve tube elements

9. There are end walls to each sieve tube element so how does the sucrose get transported along the sieve tube?
   There are sieve plates perforated by sieve pores through which microtubules extend

10. Where is the cytoplasm found in a sieve tube vessel?
    On the edge of the cell / the side walls

11. What characterises a companion cell?
    High metabolic rate with lots of mitochondria and linked to sieve tube element by plasmodesmata

12. What advantage do the vascular bundles being arranged in the stem give?
    More support to the plant

13. Why does water enter the root hair cells across their cell membranes?
    By osmosis along a water potential gradient

14. Which is the faster method of water transport through the root cells?
    Apoplast

15. What are the forces involved in the apoplast pathway?
    Cohesion of water molecules to each other aided by hydrogen bonding; also capillarity, adhesion of the water molecules to the cellulose microfibrils

16. What is the Casparian strip made of?
    Suberin

17. What is ensured by forcing water to enter the steele by the symplast route?
    That the plant has metabolic control of water transport – important for further transport into the xylem

18. How do the endodermal cells get water into the xylem?
    They actively pump ions in and water follows along a water potential gradient

19. What does this essentially cause which is a benefit to small plants?
    Root pressure to force water up the xylem

20. What kind of pressure is created in the xylem as water evaporates from the leaf?
    Negative pressure

21. What evidence is there for the cohesion-tension theory?
    If an air gap is introduced to a xylem vessel, the water cannot be transported as it is no longer a cohesive column. Also, during the day, tree trunk diameter is less due to the higher negative pressure acting on the xylem as there is more transpiration occurring

22. What two properties does lignin provide xylem vessels with?
    Waterproofing and strength against pressure

23. What does the midrib of the leaf split into?
    Veins

24. What two methods does water travel along from the xylem to the spongy mesophyll cells in the leaf?
    Symplast and apoplast routes

25. Where is water lost from in the leaf?
    The cell surface membrane of the spongy mesophyll cells

26. What are two main differences between mass flow of water and mass flow of sucrose in the vascular tissues of a plant?
    Water is one way, sucrose is two. Water is passive (non-energy dependent) and sucrose is energy requiring

27. What evidence is there that the two-way transport of sucrose is energy requiring?
    Companion cells have high rates of metabolic activity to uptake sucrose from surrounding photosynthesising cells and load it into the sieve tubes. Also, metabolic inhibitors that stop respiration e.g. cyanide, disrupts translocation of organic solutes in plants

28. Besides metabolic processes, what else can push sucrose through the plant?
    A localised build up at a source e.g. the leaf can generate a hydrostatic gradient to move the material towards a sink e.g. the roots