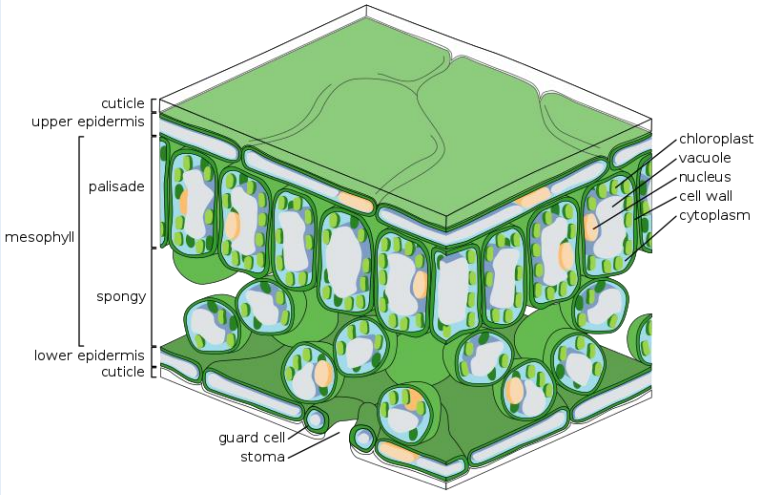
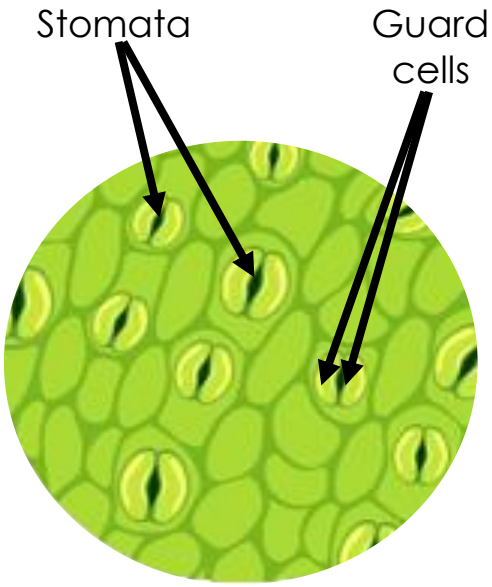
The Leaf and Roots (prior knowledge review)

1. The leaf is a plant organ, containing the epidermis, palisade and spongy mesophyll, xylem and phloem, and guard cells surrounding stomata.

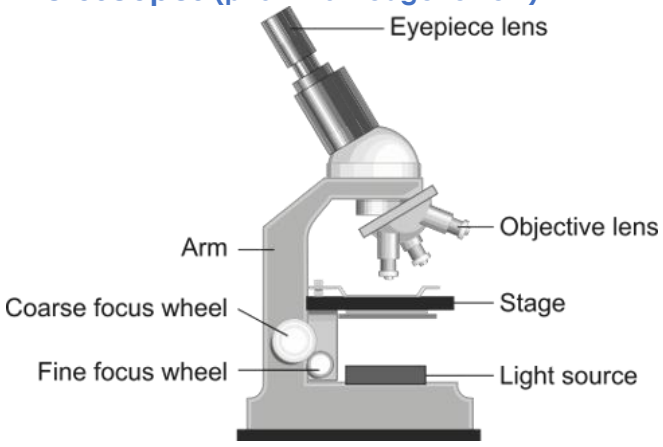


2. The leaf epidermis is adapted for transmitting light to the palisade layer because it is the transparent top layer
3. The leaf epidermis is adapted for preventing water loss from leaf cells because it has a waterproof, waxy cuticle surrounding it
4. The palisade mesophyll is adapted for carrying out photosynthesis because it contains many palisade cells which contain many chloroplasts
5. The spongy mesophyll is adapted for diffusion of gases for photosynthesis because it contains air spaces between cells
6. Guard cells open and close small holes called stomata on the underside of the leaf to control gas exchange and water loss
7. Stomatal density can be calculated by counting the number of stomata seen in a known area using the light microscope.



8. Root hair cells are adapted for the efficient uptake of water by osmosis because they have a large surface area
9. Root hair cells are adapted for the efficient uptake mineral ions by active transport because they have a large surface area and many mitochondria
10. Active transport moves substances from a more dilute solution to a more concentrated solution, requiring energy from respiration

Microscopes (prior knowledge review)



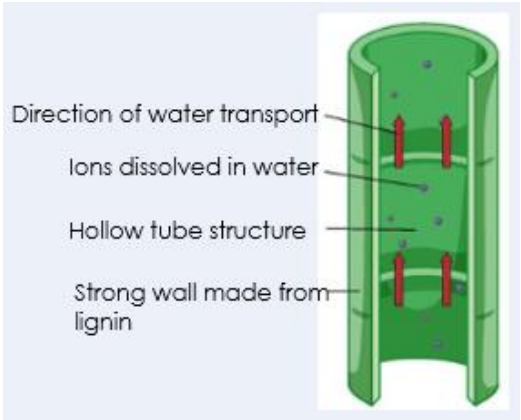
11. Microscopy is the field of using microscopes to view samples that cannot be seen with the naked eye

12. Light microscopes allow us to see the largest organelles, including the nucleus, cell membrane, cell wall and cytoplasm. A stain is often used to make the organelles clearer
13. The parts of a light microscope include the eyepiece lens, objective lenses, stage, coarse focusing wheel, fine focusing wheel, light/mirror
14. A sample used with a light microscope must be very thin to allow light to pass through
15. The specimen to be viewed under a microscope is placed on the stage and secured with stage clips
16. The eyepiece lens and objective lens are used to increase the size of the image
17. The coarse focusing wheel is used to move the stage and get the cells into frame
18. The fine focusing wheel is used to sharpen an image
19. The total magnification of a microscope can be calculated using the following equation: Total magnification = Objective lens x eyepiece lens
20. Electron microscopes have a greater magnification and resolution than light microscopes. They are much more expensive than light microscopes
21. Magnification is the number of times larger an image is than the object
22. Resolution is the ability to distinguish between two points
23. Electron microscopes allow are to see more organelles and study cells in greater detail
24. A scale bar can be used to calculate the magnification of an irregular object
25. Magnification does not have a unit because it is a ratio
26. Magnification = size of image/size of object

Transpiration

27. The roots, stem and leaves form a plant organ system for transport of substances around the plant.

28. Transpiration is the process of water moving through a plant and its evaporation from parts such as through the stomata on the underside of leaves.
29. Changing temperature, humidity, air movement and light intensity affect the rate of transpiration.
30. Xylem tissue transports water and mineral ions from the roots to the stems and leaves

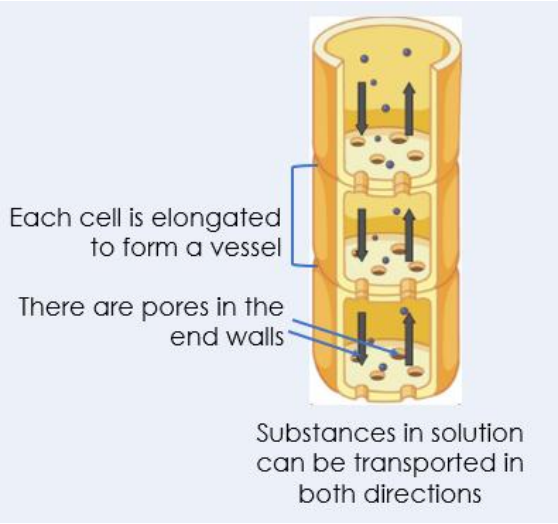


31. It is composed of hollow tubes strengthened by lignin adapted for the transport of water in the transpiration stream.

32. Stomata and guard cells control gas exchange and water loss.

Translocation

33. Phloem tissue transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage.
34. The movement of food molecules through phloem tissue is called translocation.
35. Phloem is composed of tubes of elongated cells.



36. Cell sap can move from one phloem cell to the next through pores in the end walls.

Photosynthesis and Uses of Glucose

37. Photosynthesis is represented by the word equation:

carbon dioxide + water → glucose + oxygen

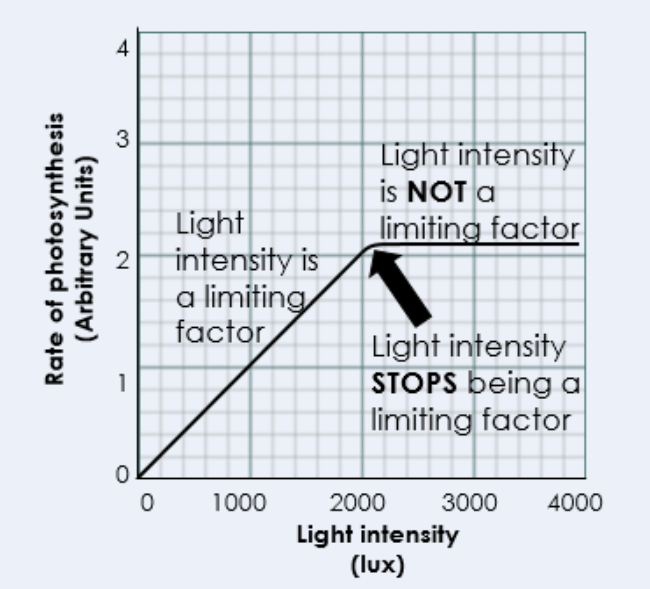
38. Photosynthesis is represented by the symbol equation:

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

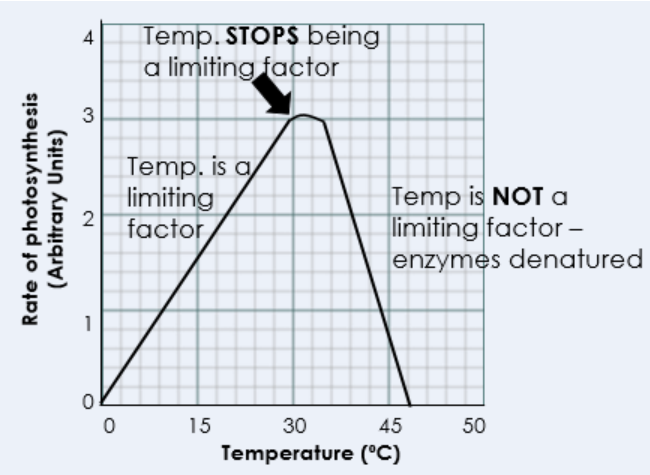
39. Photosynthesis is a chemical reaction in which energy is transferred from the environment to the chloroplasts by light
40. Photosynthesis is carried out in chloroplasts
41. Chlorophyll is a green pigment found in chloroplasts that absorbs the sunlight required for photosynthesis
42. The glucose produced in photosynthesis may be used as a reactant for respiration
43. The glucose produced in photosynthesis may be converted into insoluble starch for storage
44. The glucose produced in photosynthesis may be used to produce fat or oil for storage
45. The glucose produced in photosynthesis may be used to produce cellulose, which strengthens the cell wall
46. The glucose produced in photosynthesis may be used to produce amino acids for protein synthesis
47. To produce proteins, plants also use nitrate ions that are absorbed from the soil

Limiting Factors in Photosynthesis

48. Temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll affect the rate of photosynthesis
49. A limiting factor of photosynthesis is something that, when in limited supply, stops the maximum rate of photosynthesis
50. Increasing the carbon dioxide concentration or the intensity of light increases the rate of photosynthesis proportionally until there is a limiting factor that causes the rate to become constant



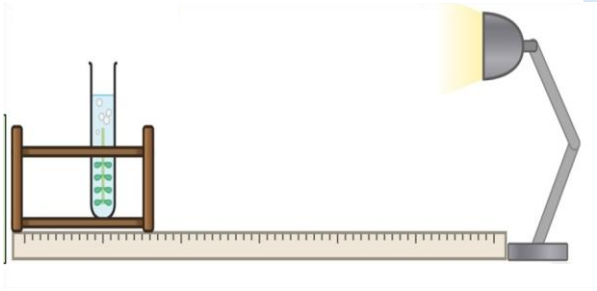
51. Increasing the temperature increases the rate of photosynthesis proportionally until it reaches the optimal temperature for enzymes then the rate decrease



52. (HT Only) Limiting factors of photosynthesis interact and any one of them may be the factor that limits photosynthesis
53. (HT Only) Explain graphs of photosynthesis rate involving two or three factors and decide which is the limiting factor
54. (HT Only) Limiting factors are important in the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit

RP: The Effect of Light Intensity on Photosynthesis

55. Changing the distance between a lamp and pondweed and then counting the number of oxygen bubbles produced per minute allows us to investigate how light intensity affected photosynthesis



56. (HT Only) The relationship between light intensity and distance squared is inversely proportional
57. (HT Only) The relationship between light intensity and the inverse of distance squared is a directly proportional relationship.

TIF: Plant Diseases and Defences

58. Tobacco mosaic virus (TMV) infects many plants including tomato plants
59. TMV causes a distinct 'mosaic' pattern of discolouration on leaves. This means that leaves cannot absorb light for photosynthesis so the plant does not grow normally
60. Rose black spot is a fungal disease where purple/black spots form on leaves. This means that leaves cannot absorb light for photosynthesis so the plant does not grow normally
61. Fungal infections are treated using fungicide chemicals
62. Plants have to defend themselves; they can be infected by a range of viral, bacterial and fungal pathogens as well as by insects and animals.

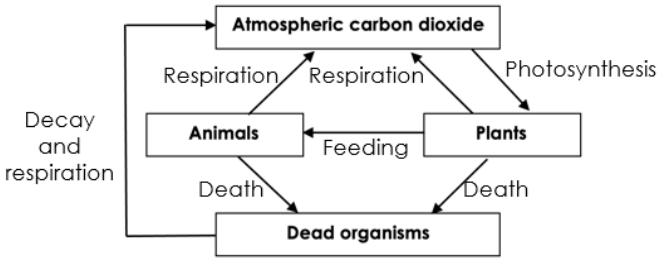
63. **Physical defence responses** which resist invasion of microorganisms include; Cellulose cell walls, Tough waxy cuticle on leaves, and layers of dead cells around stems (bark on trees) which fall off.
64. **Chemical defence responses** include antibacterial chemicals and poisons to deter herbivores.
65. Mechanical **defence responses** include thorns and hairs deter animals and leaves which droop or curl when touched.
66. (HT Only) Plant diseases can be detected by stunted growth, spots on leaves, areas of decay (rot, growths, malformed stems or leaves, discolouration, the presence of pests.
67. (HT Only) Identification can be made by: reference to a gardening manual or website, taking infected plants to a laboratory to identify the pathogen, using testing kits that contain monoclonal antibodies

Material Cycling: Decay

68. Many different materials cycle through the abiotic and biotic components of an ecosystem.
69. All materials in the living world are recycled to provide the building blocks for future organisms.
70. Microorganisms help to cycle materials through an ecosystem by returning carbon to the atmosphere as carbon dioxide and mineral ions to the soil.
71. Decomposers are organisms that break down dead organisms using enzymes
72. Types of bacteria and fungi are decomposers

Material Cycling: The Carbon Cycle

73. The carbon cycle is important for the survival of living organisms.
74. In the carbon cycle:
    - carbon dioxide is absorbed by plants for photosynthesis
    - carbon dioxide is released by animals and plants during respiration
    - carbon is transferred to consumers in the food chain



75. Microorganisms help to cycle materials through an ecosystem by returning carbon from dead organisms to the atmosphere as carbon dioxide as they respire

Material Cycling: The Water Cycle

76. The water cycle is important for the survival of living organisms.
77. Water is continuously evaporated and precipitated.
78. The water cycle provides fresh water for plants and animals on land before draining into the seas.

TIF Investigating the Rate of Decay

79. Decreasing the temperature lowers the rate of decay because decomposing microorganisms are less active
80. Decreasing the availability of oxygen lowers the rate of decay because decomposing microorganisms cannot respire
81. Decreasing the availability of water lowers the rate of decay because decomposing microorganisms cannot survive
82. Gardeners and farmers try to provide optimum conditions for rapid decay of waste biological material. The compost produced is used as a

natural fertiliser for growing garden plants or crops.

TIF Biogas Generators

83. Anaerobic decay produces methane gas.
84. Biogas generators can be used to produce methane gas as a fuel.