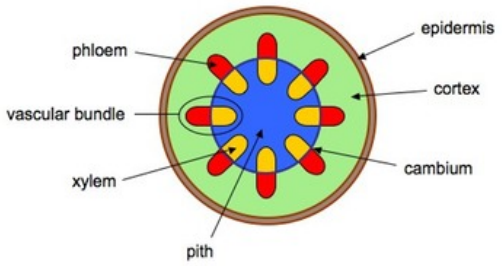
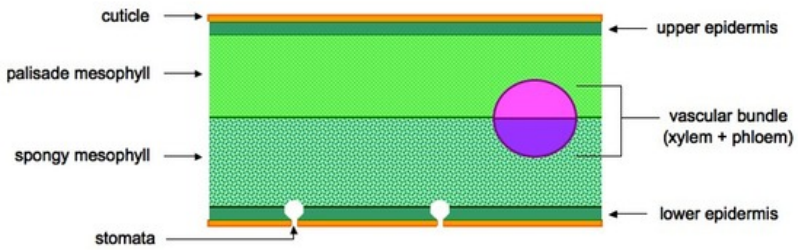
9.1 Plant Structure and Growth

9.1.1 Draw and label plan diagrams to show the distribution of tissues in the stem and leaf of a dicotyledonous plant

Stem Tissue



Leaf Tissue



9.1.2 Outline three differences between the structures of dicotyledonous and monocotyledonous plants

Structure	Monocotyledons	Dicotyledons
Number of cotyledons	One	Two
Leaf veins	Parallel venation	Reticulated venation
Roots	Fibrous adventitious roots	Tap roots with lateral branches
Floral organs	Multiples of 3	Multiples of 4 or 5
Stem vascular arrangement	Scattered	In a ring
Pollen	Single furrow / pore (monosulcate)	Three furrows / pores (trisulcate)

➡ Monocotyledons versus Dicotyledons

9.1.3 Explain the relationship between the distribution of tissues in the leaf and the function of these tissues

Upper Epidermis

- *Function:* Main function is water conservation (secretes cuticle to create a waxy outer boundary)
- *Distribution:* On top of leaves where light intensity and heat are greatest

Palisade Mesophyll

- *Function:* Main photosynthetic tissue (cells contains many chloroplasts)
- *Distribution:* Upper half of leaf where light intensity is greatest (upper epidermal cells are transparent)

Spongy Mesophyll

- *Function:* Main site of gas exchange (made of loosely packed cells with spaces)
- *Distribution:* Lower half of leaf, near the stomatal pores (where gases and water are exchanged with the atmosphere)

Vascular Tissue

- *Function:* Transport of water (xylem) and the products of photosynthesis (phloem)
- *Distribution:* Found in middle of leaf (allowing all cells optimal access)

9.1.4 Identify modifications of roots, stems and leaves for different functions: bulbs, stem tubers, storage roots and tendrils

- A storage organ is a part of a plant specifically modified to store energy (e.g. carbohydrates) or water
- They are usually found underground (better protection from herbivores) and may result from modifications to roots, stems or leaves:
  - **Storage roots:** Modified roots that store water or food (e.g. carrots)
  - **Stem tubers:** Horizontal underground stems that store carbohydrates (e.g. potato)
  - **Bulbs:** Modified leaf bases (may be found as underground vertical shoots) that contain layers called scales (e.g. onion)
- Some plants (called succulents) have modified leaves or stems (thickened, fleshy and wax-covered) to enable water storage (e.g. cacti)
- Other plants (e.g. vines) have modifications to their leaf or stem to enable climbing support and attachment - these are called **tendrils**

Modifications to Plant Structure

Storage Roots

Stem Tubers

Bulbs

Tendrils

9.1.5 State that dicotyledonous plants have apical and lateral meristems

- A meristem is a tissue in a plant consisting of undifferentiated cells (meristematic tissue) and are found in zones where growth can take place
- Meristematic cells are analogous to stem cells in animals, however have specific regions of growth and development (unlike stem cells)
- Dicotyledonous plants have apical and lateral meristems

9.1.6 Compare growth due to apical and lateral meristems in dicotyledonous plants

Similarities:

- Both are composed of totipotent cells (able to divide and differentiate)
- Both are found in dicotyledonous plants

Differences:

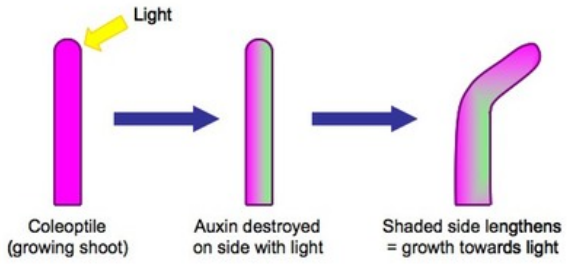
Apical Meristems	**Lateral Meristems**
Occurs at the tips of roots and shoots	Occurs at the cambium
Adds vertical growth to roots and shoots (increase length)	Adds lateral growth to stem (increase width)
Responsible for primary growth	Responsible for secondary growth
Develops into primary xylem and phloem	Produces secondary xylem and phloem
Produces new leaves and flowers	Produces the bark on trees

9.1.7 Explain the role of auxin in phototropism as an example of the control of plant growth

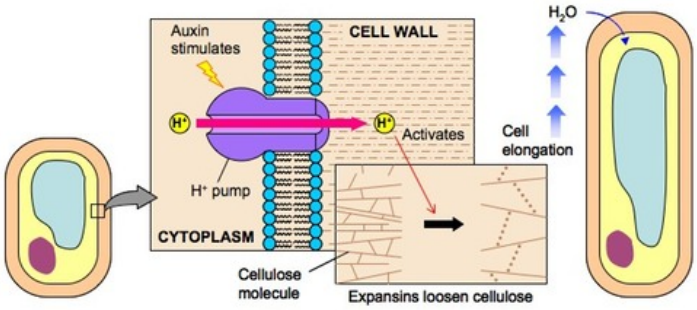
- Phototropism is the growing or turning of an organism in response to a unidirectional light source
- Auxins (e.g. IAA) are plant hormones that are produced by the tip of a shoot and mediate phototropism

- Auxin makes cells enlarge or grow and, in the shoot, are eradicated by light
- The accumulation of auxin on the shaded side of a plant causes this side only to lengthen, resulting in the shoot bending towards the light
- Auxin causes cell elongation by activating proton pumps that expel H^+ ions from the cytoplasm to the cell wall
- The resultant decrease in pH within the cell wall causes cellulose fibres to loosen (by breaking the bonds that hold them together)
- This makes the cell wall flexible and capable of stretching when water influx promotes cell turgor
- Auxin can also alter gene expression to promote cell growth (via the upregulation of expansins)

The Role of Auxin in Phototropism



Phototropism



Mechanism of Auxin