

# Growth

Methods of measuring growth

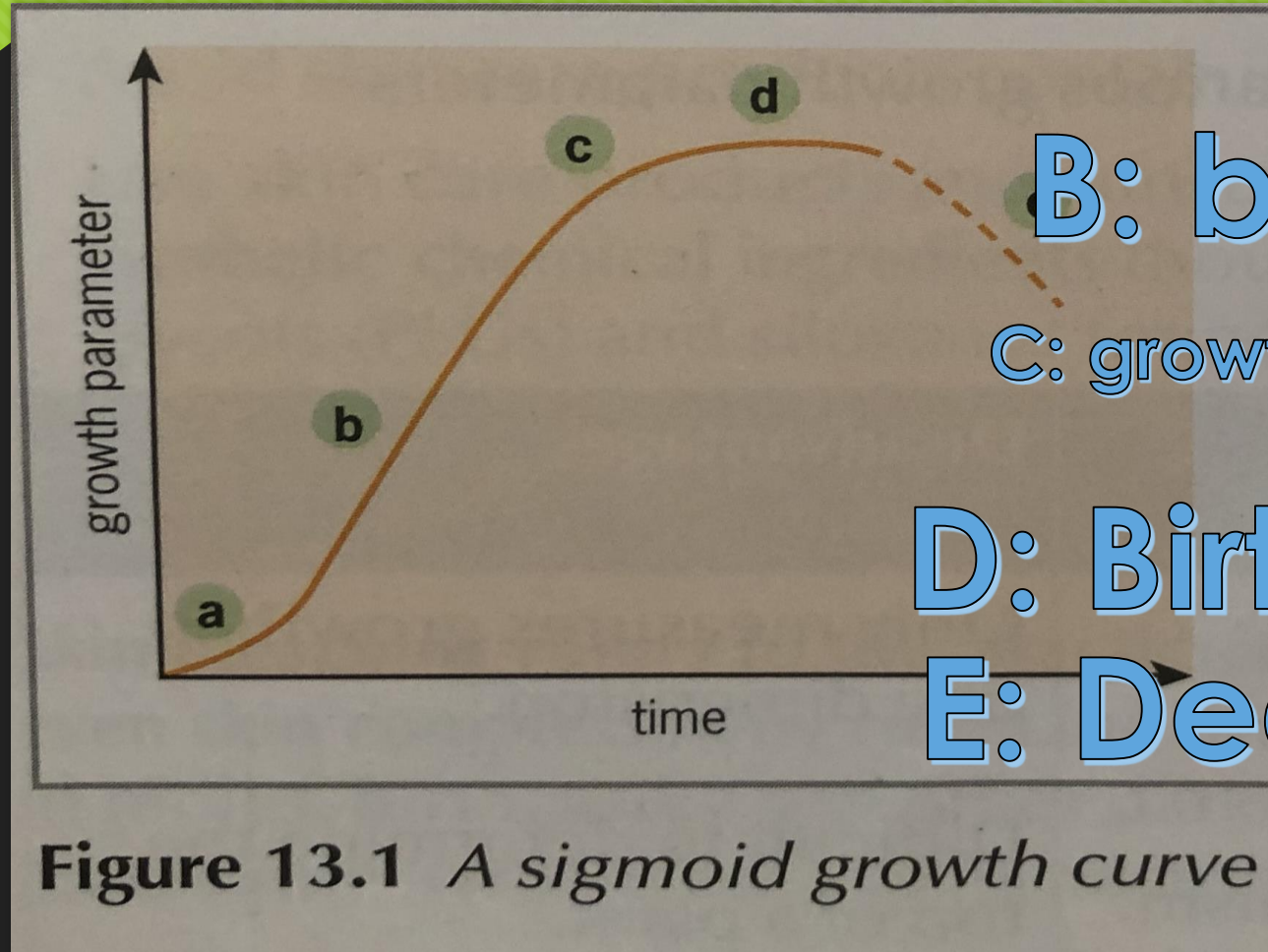
# Methods

Parameter being measured	Used to measure growth of	Advantages	Disadvantages
Height	Humans. Small plants.	Quick to measure. Easy to measure. Doesn't harm the organism.	Only measures growth in one dimension. Difficult to determine the top of a plant.
Length	Bodies of animals. Parts of animals, e.g. legs, wings, tails. Stems. Leaves.	Quick to measure. Easy to measure. Doesn't harm the organism.	Only measures growth in one dimension. Only measures the growth of part of an organism.
Wet mass	Most animals. Small plants.	Quick to measure. Easy to measure. Doesn't harm animals. Gives a more accurate measure of overall growth than height or length.	Measurements may be inconsistent due to changes in water content of the bodies of organisms. Plant growth is disturbed when plants are uprooted and the roots cleaned.
Dry mass	Germinating seeds and seedlings. Small plants. Small animals, e.g. invertebrates.	Gives the most accurate measure of growth because it measures cellular and extracellular material without water.	Time consuming; organisms have to be dried at 100 °C to constant mass. Organisms are killed. Large numbers of organisms are required.
Number of leaves	Small plants.	Relatively quick. Easy to count.	Only measures one aspect of growth.

Parameter being measured	Used to measure growth of	Advantages	Disadvantages
Surface area of leaves	Plants	Gives a more accurate measure of overall growth than leaf length.	Time consuming; leaves have to be outlined on squared paper and then squares counted.
Number of organisms	Population	Relatively quick	Can be difficult for animal populations since animals move.

# Sigmoid growth curve.

A: SLOW



B: birth > Death

C: growth slowing down

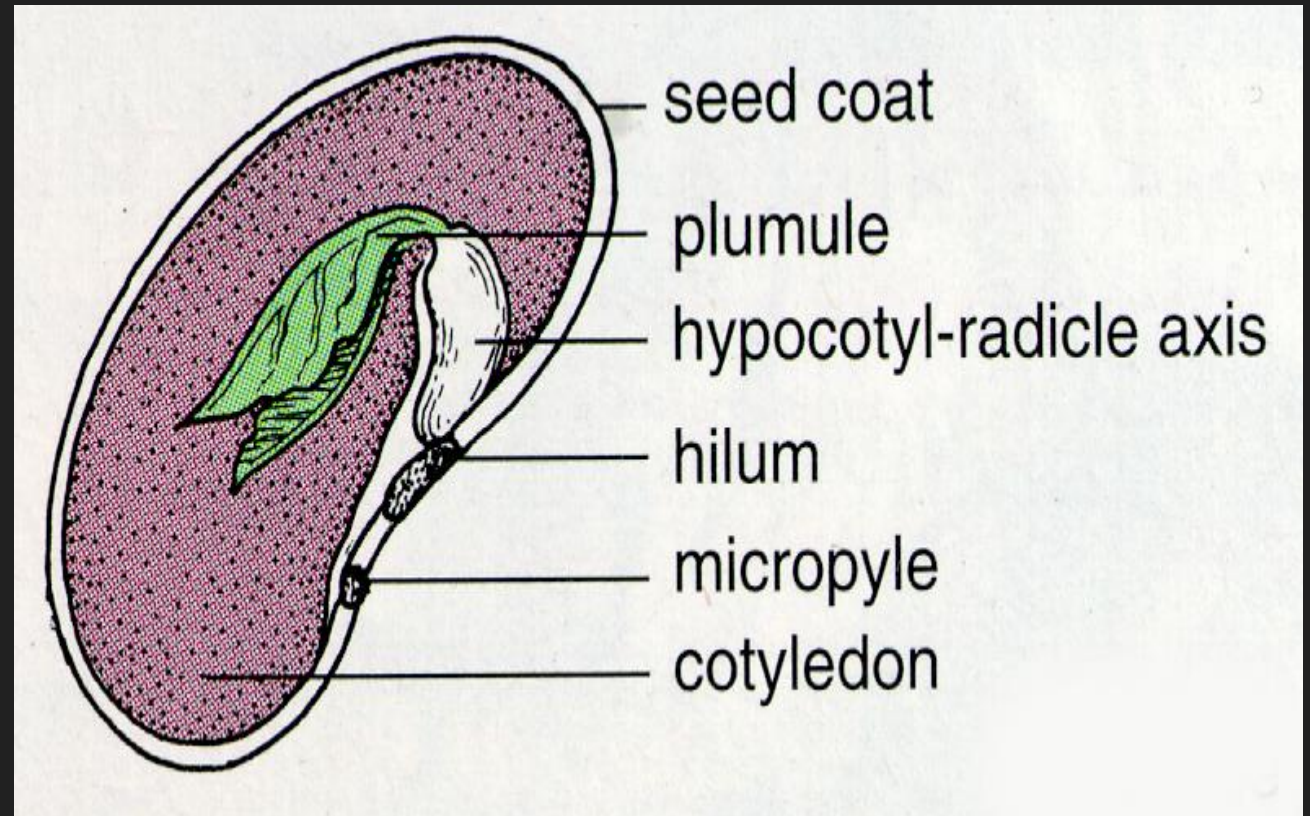
D: Birth = Death

E: Death > Birth



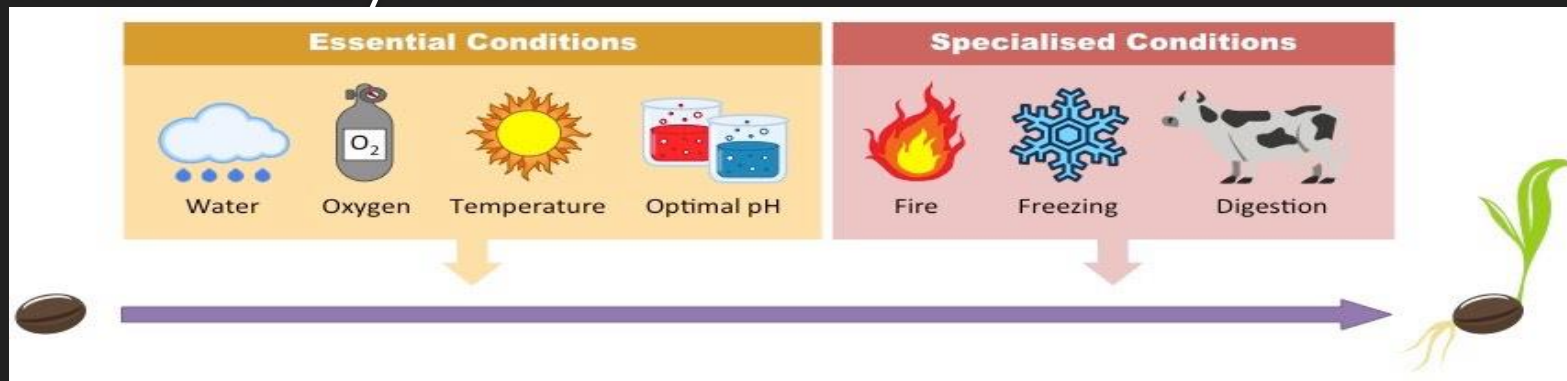
# Germination

- Is the process by which the embryonic plant in a seed grows into a seedling.

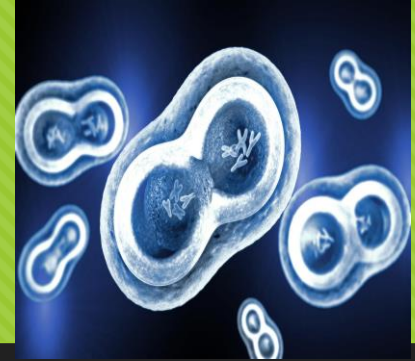


# Conditions for germination to occur.

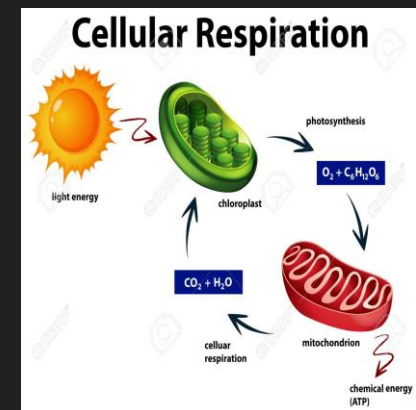
- Water to activate the enzymes so that chemical reactions can occur.
- Oxygen for aerobic respiration to produce energy.
- A suitable temperature, usually between 5C and 40C to activate enzymes.



# Break down of food.



- Amino acids, used to make new cells in the tips of the radicle and plumule so that growth can occur.
- The glucose is used in respiration to produce energy for the radicle and plumule to grow and to make the cellulose cell walls of new cells.
- Fatty acids and glycerol are used in respiration.





# Stages of germination

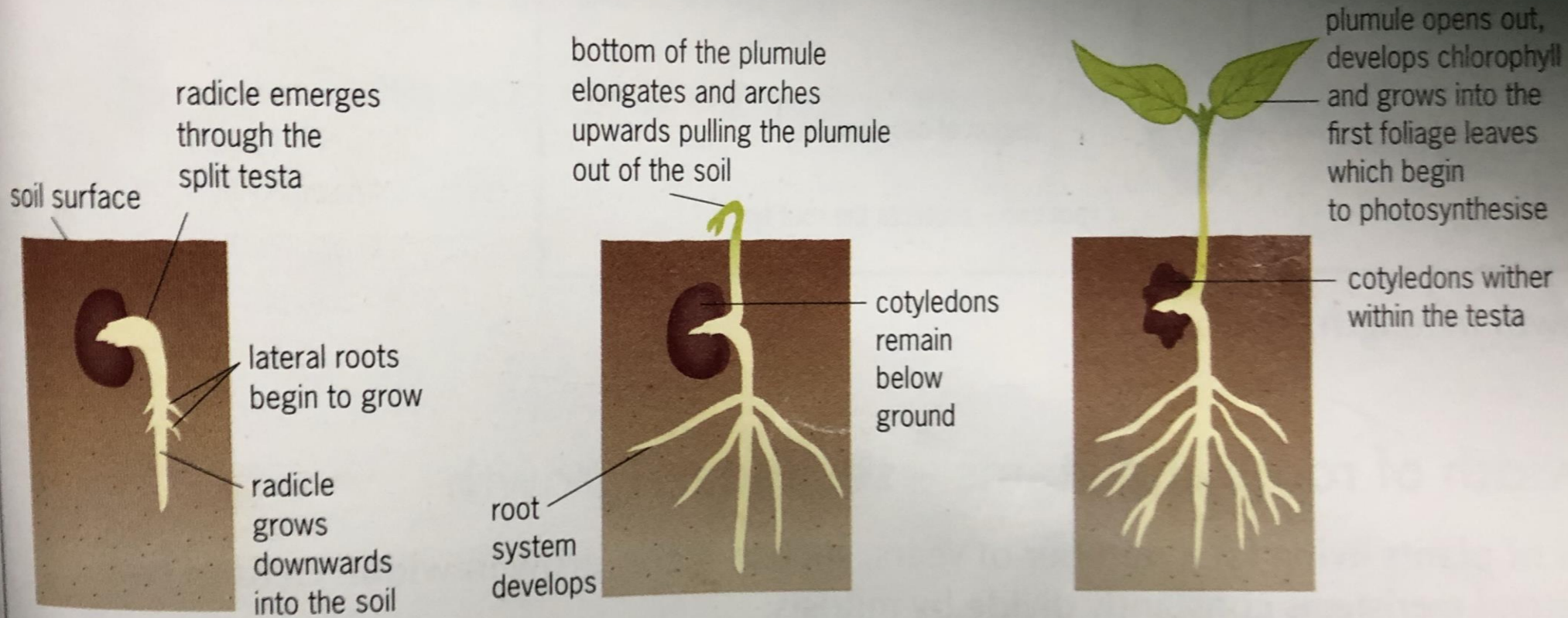
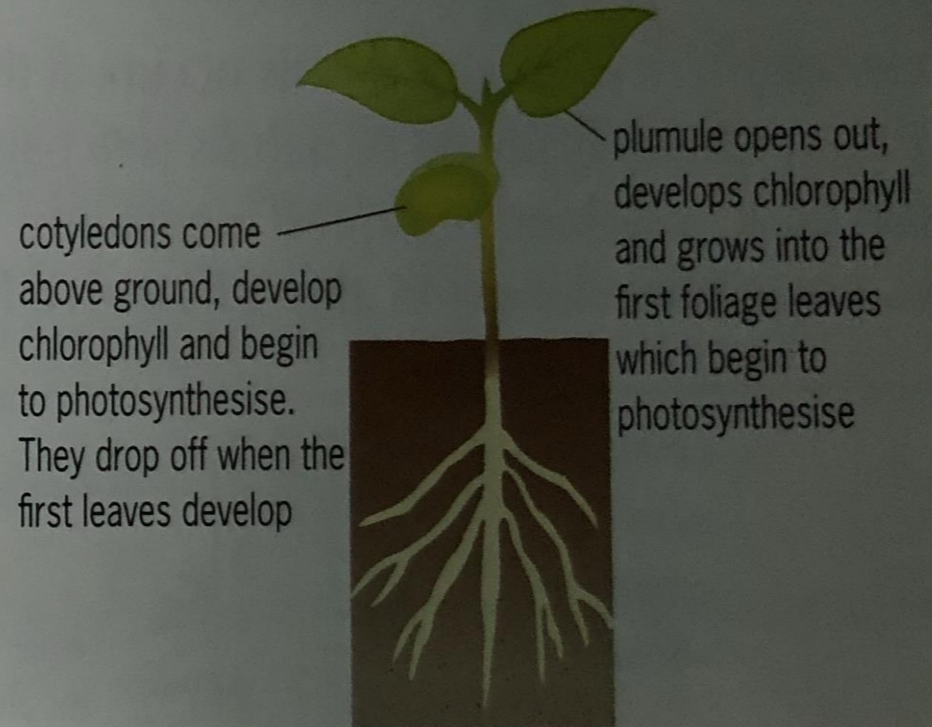
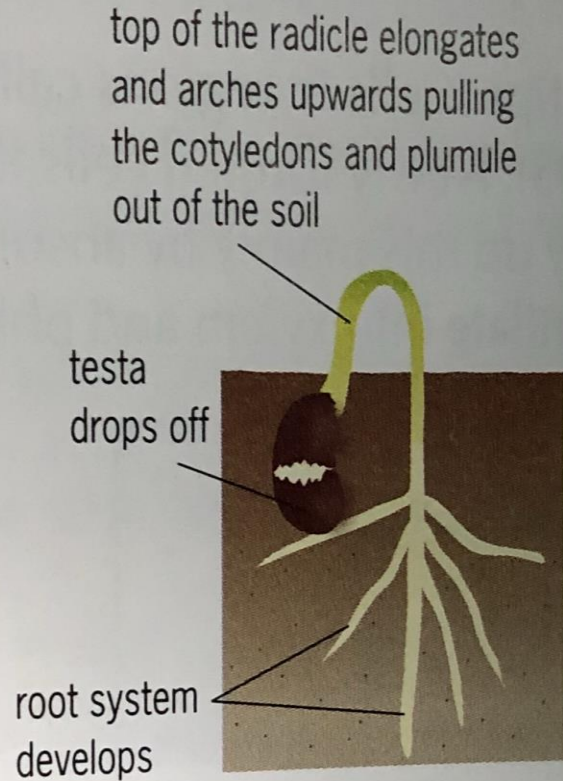
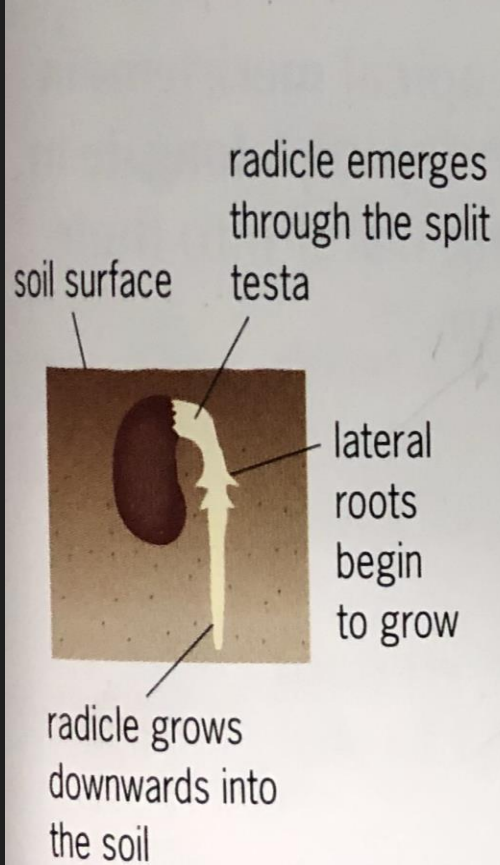


Figure 13.4 Stages in the germination of a pigeon pea



# Stages of germination



# Growth curve of germinating seed

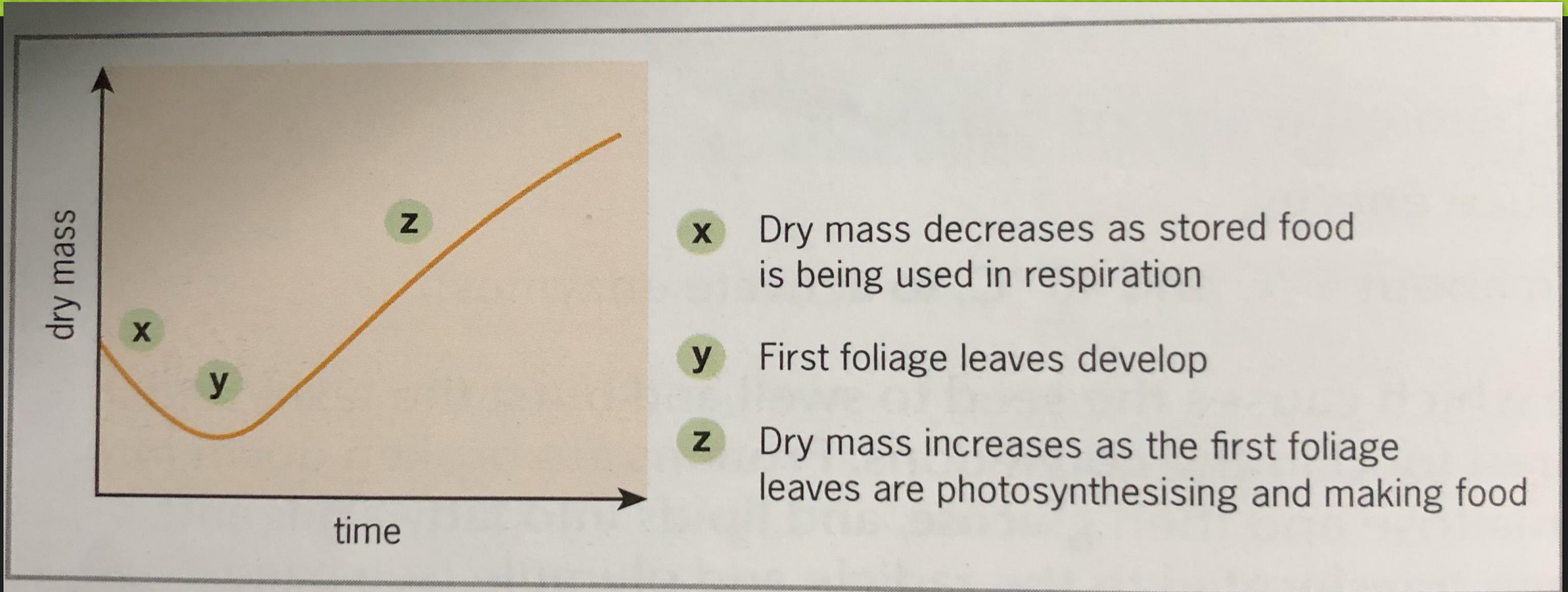
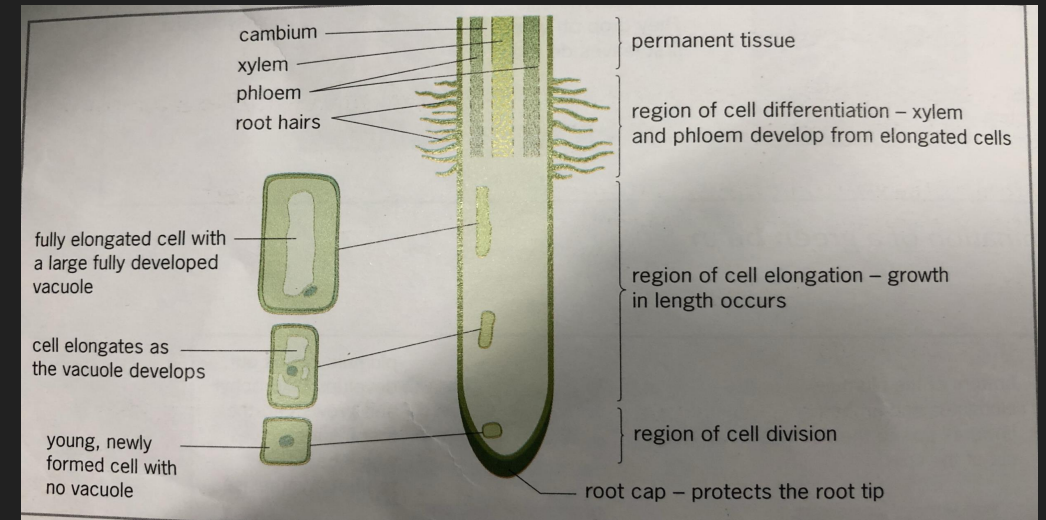


Figure 13.5 *Growth curve of a germinating seed*

# Meristems

- Plant cells have semi-rigid cell walls that restrict their ability to divide and grow. Consequently, plants have groups of immature cells which have thin walls and that retain the ability to actively divide and grow. ( form the only active growing tissue in plants).





cambium

xylem

phloem

root hairs

permanent tissue

region of cell differentiation – xylem and phloem develop from elongated cells

fully elongated cell with a large fully developed vacuole

cell elongates as the vacuole develops

young, newly formed cell with no vacuole

region of cell elongation – growth in length occurs

region of cell division

root cap – protects the root tip

