SENIOR SIX TERM 2

TOPIC 2/2: Growth in Plants and Development in Insects

Competency: The learner justifies changes in the size and complexity of plants and insects, through data analysis of research findings, in order to develop strategies to improve agricultural productivity and environmental sustainability.

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Growth and development

Growth is a permanent increase in size of an organism by addition of more body substance. The pattern of growth differs in different organisms. For plants however, have particular regions where they grow, called **meristems**.

Apical meristems are responsible for increase in length while secondary meristems are responsible for increase in girth or diameter of the stem. Three distinct process of contribute to growth; cell division, assimilation, and cell expansion.

Development; involve both an increase in size and differentiation of cell so that they become specialized.

Measuring growth

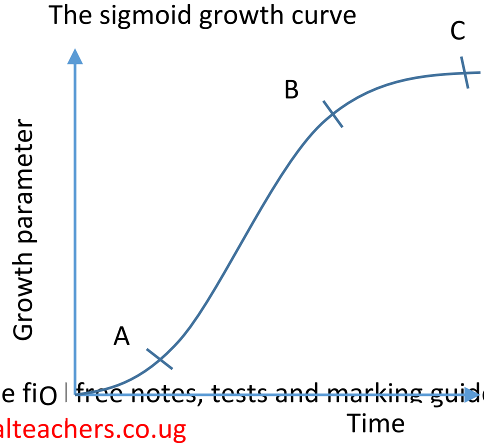
Growth can be quantified by measuring some features of the organism at suitable interval such as

1. Length: this is easy to do and does not damage the organism but results may be misleading because it takes no account of growth in other direction.
2. Area and volume are more accurate than measuring length but are impractical to measure.
3. Fresh mass: this is easy to measure but may be inaccurate due to temporary fluctuation in water content
4. Dry mass: this involves removing all water by drying before weighing. It is accurate but difficult to carry out and kills the organism

Growth curves

When any parameter is measured against set intervals of time, a growth curve is produced. Form many populations, organism or organs, the curve is S-shaped or **sigmoid curve**. It represents a slow growth at first, because there are so few cells initially that even when they are dividing rapidly the actual increase in size is small.

The sigmoid growth curve



Explanation of the graph

OA: Slow growth due very dividing cells

AB: Exponential growth due to presence of big number of dividing cell

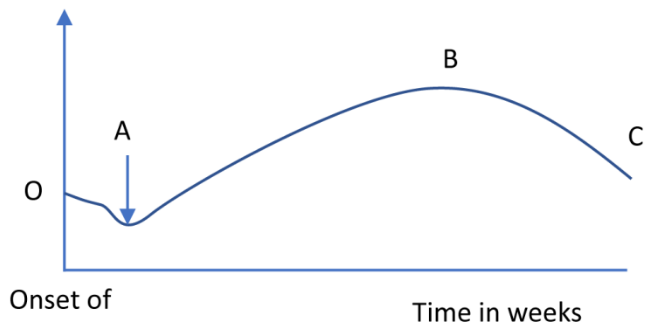
BC Growth slows down and finally stops due rate of cell division equal to rate of cell death or cell division limited by the genotype of the animal.

Limited and unlimited growth

Growth in plant and animal show two basic of growth i.e. limited [definite or determinate] growth and unlimited [indefinite or indeterminate] growth

Growth in annual plants

Growth in annual plant is limited and after a period of maximum growth, during which the plant matures and reproduce, there is a period of negative growth or senescence before the death of the plant. If the dry mass of the annual plant is plotted against time then sigmoid curve given below as obtained



Explanation of the graph

-The negative growth in the first week is due to respiration of food reserves in the seed

-At A, the green leaves have now grown and opened above ground.

-Along AB dry mass increases because photosynthesis is greater than respiration

-Along BC, dry mass decreases due to dispersal of fruits and seed, loss of leaves / chlorophyll and high respiration as compared photosynthesis.

Several organs show limited growth but do not undergo a period of negative growth e.g., leaves and stem internodes. Animals that show limited growth include insects, birds and mammals.

Unlimited growth is seen in woody perennial plants and some invertebrates, fishes and some reptiles

In plants growth only occurs in group of immature cells called **meristems**.

Meristems

A meristem is a region of plant tissue, found chiefly at the growing tips of roots and shoots and in the cambium, consisting of actively dividing cells forming new tissue

The meristem has a number of defining **features**, including small cells, thin cell walls, large cell nuclei, absent or small vacuoles, and no intercellular spaces.

It is divided into three zones.

(i) The zone of cell division is closest to the tip and is made up of the actively-dividing cells of the root meristem, which contains the undifferentiated cells.

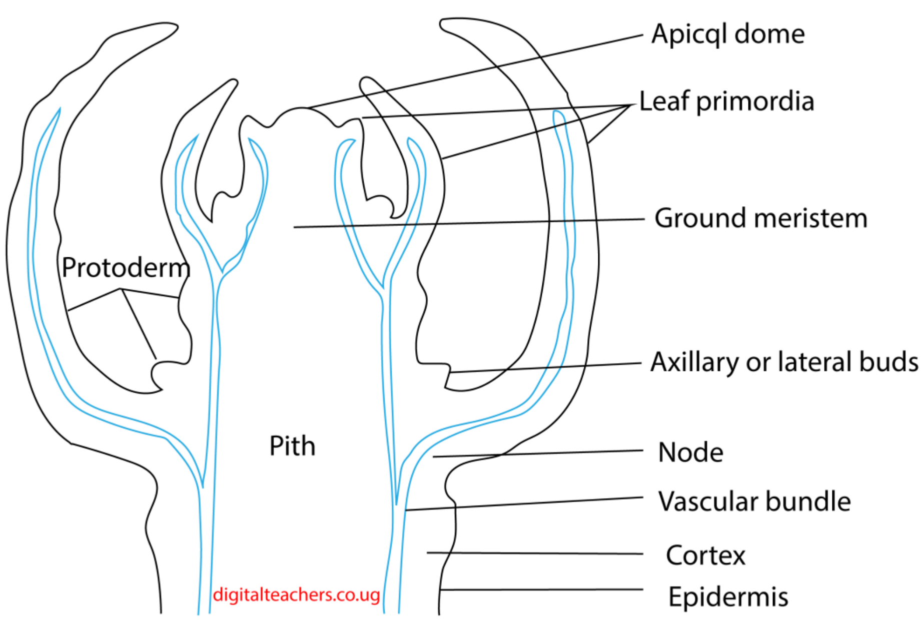
(ii) The zone of elongation is where the newly-formed cells increase in length, thereby lengthening the root and shoot

(iii) The zone of cell maturation where the elongated cells differentiate into specialized cell types

There are three types of meristems: -

1. **Apical meristems:** these are found at the tips of roots and shoots and are responsible for primary growth of the plants i.e., increase in length.

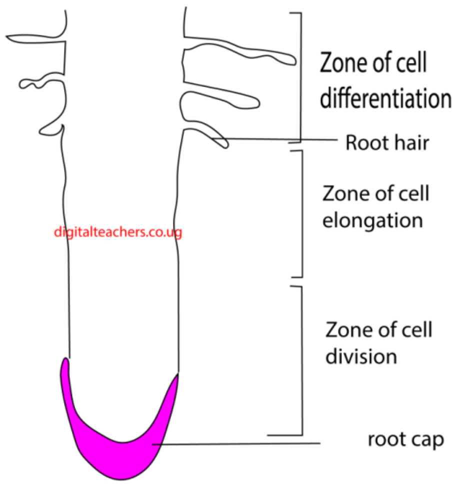
Shoot apical meristem



Role of apical meristem in growth

- Cell division and elongation causes increase in length
- Bud primodium give rise to bud which can develop gives rise to branches
- Pro-cambium gives rise to vascular tissue

Root cap meristem



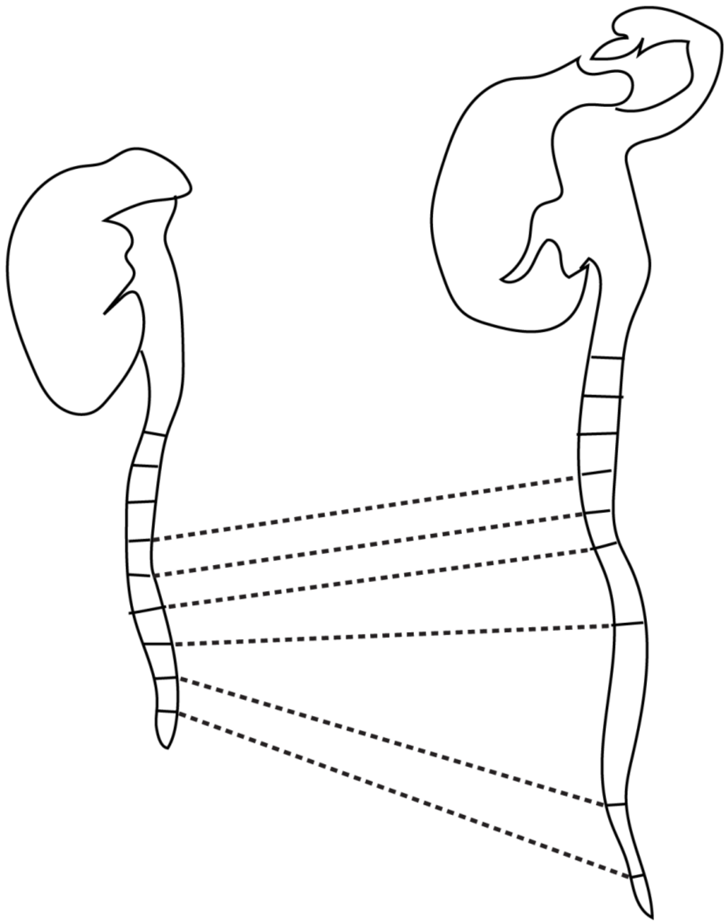
Role of root cap meristem

- Root cap protects the delicate root tip
- Cell division and expansion leads to increase in leangth
- Cell differentiation leads to formation of differents tissues

2. **Lateral meristems:** these are found in a cylinder towards the outside of the stem and roots. They are responsible for secondary growth and cause increase in girth.
3. **Intercalary meristems:** these are found at the nodes in monocotyledonous plants. They allow an increase in length in positions other than the tip.

Experiments to determine the region of growth in a root

1. Take a freshly-germinated bean with a root about 2.5cm long. Mark the root every 2mm with line in permanent black ink.
2. Pin the bean to the underside of a cork, with the root hanging downwards, and put the cork into the moist cotton wool
3. After 2-3 days, the region of growth is indicated by the part where the black line are linger than 2mm.



Germination

Seed germination may be defined as the fundamental process by which different plant species grow from a single seed into a plant

Conditions necessary for germination

1. Water
   The role of water in seed germination may be
- Dissolve and leak away germination inhibitors
- Soften and rapture seed coat to allow in water and oxygen
- hydrate vital activities of protoplasm
- converts the insoluble food into soluble form for its translocation to the embryo
2. Oxygen is necessary for aerobic respiration
3. Temperature; moderate temperature (25 – 300C) activates enzymes.

Others

4. Light: some seed require exposure to sunlight before they germinate

.

Experiment to demonstrate conditions necessary germination

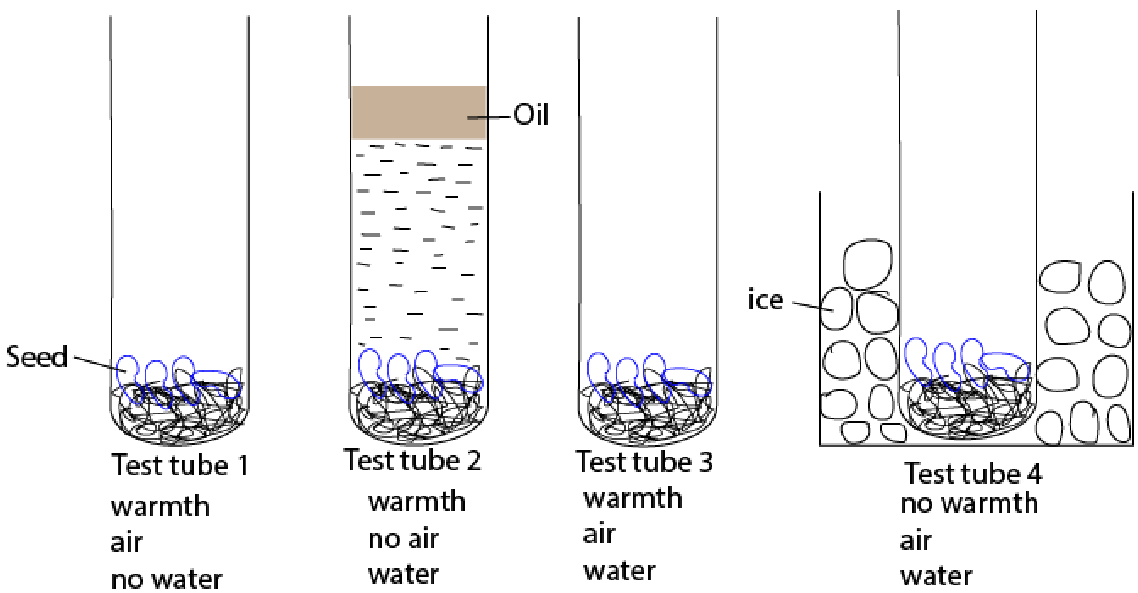
Prepare 4 test tubes as follow

Test tube 1: place dry seeds on cotton and place in a test tube in a warm place such that seed are provided with air and warmth but no water

Test tube 2: seeds on a cotton wool are placed in a test tube full of freshly boiled and cooled water and then covered with oil to prevent entry of air.

Test tube 3: seeds in soaked cotton wool are placed in an open test tube and placed in a warm place. These seed have warmth, oxygen and water

Test tube4: seeds in soaked cotton wool are placed in an open test tube and test tube placed in a a beaker if ice



The setup is left for a few days

Observations

Seeds in test tube 3 germinated because they were provided with warmth, oxygen and water

Physiology of seed germination

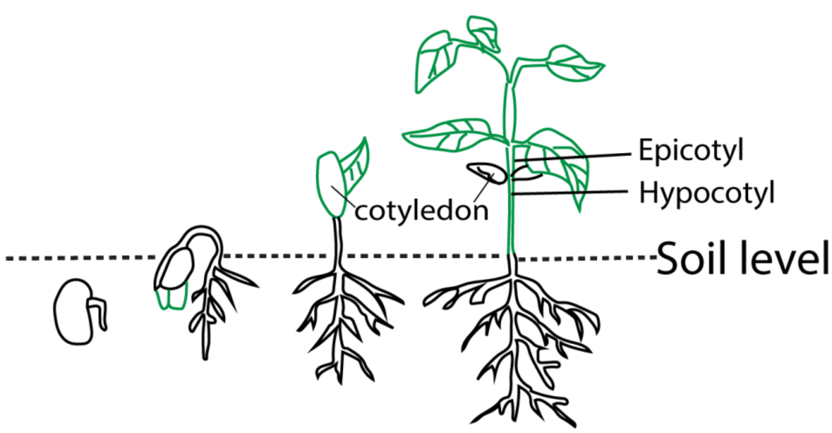
- Germination starts with the rapid uptake of water by the seed through the micropyle by a process called ambition. Water then moves from cell by osmosis.

- The water causes swelling of the embryonic tissue thereby rapturing the seed coat and also activates gibberellins.
- Gibberellins diffuse to the aleurone layer (a special layer which one cell thick **that surrounds the endosperm).** Here gibberellins cause the synthesis and activation of hydrolytic enzymes such as amylase and proteases.
- Amylase catalyzes the breakdown of starch to glucose while proteases catalyze hydrolysis of proteins to amino acids.
- Glucose and amino acids are translocated from the storage centre (endosperm or cotyledon) of the seed to the growing regions of the embryo.
- Here glucose is used in respiration and in the formation of cellulose and other cell wall materials. Amino acids are used to make proteins, which are enzymes and structural components of protoplasm.
- Cell division, elongation and differentiation leads to immergence of a seedling from a seed.

Types of germination

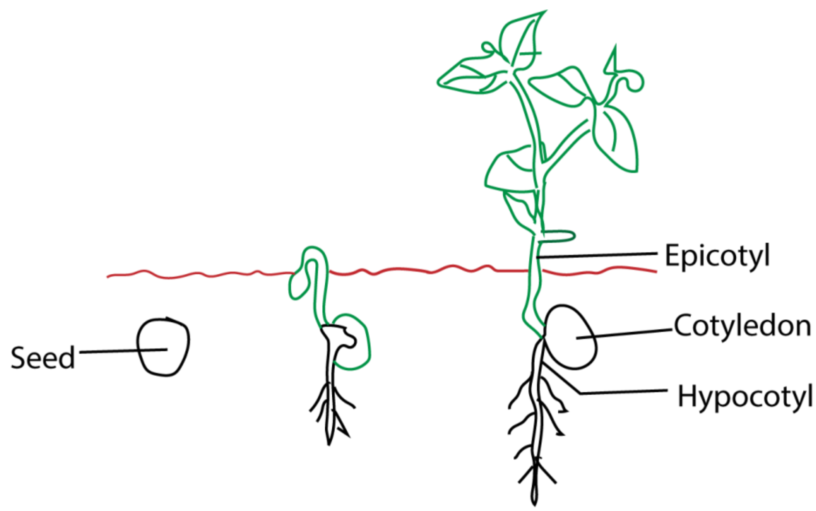
1. Epigeal germination

   Here hypocotyl grows faster than epicotyl causing the cotyledon to grow above ground



2. Hypogeal germination

   Here epicotyl grows faster than hypocotyl that the cotyledons remain under the soil.



Seed Dormancy

Is the state in which a seed that is viable will not germinate even if the conditions that are necessary for germination are provided?

Dormant seed are usually dry, their metabolic activity is much reduced and they respire anaerobically.

Importance of seed dormancy

- Seed are able to withstand adverse external conditions such as very cold or very dry whether.
- It allows seed and fruits to disperse

Causes of seed dormancy

The main factors that causes the seed dormancy are:

1. **Seed coats impermeable to water** and **oxygen**:
2. **hard seed coats** that prevent the expansion of embryo.
3. **Immature embryo**
4. **Presence of germination inhibitor**
5. **Absence of light required for germination of seeds**

How to break seed dormancy

(i) scarification (mechanically or chemically weakening the seed coat)

(ii) stratification (chilling seeds

(iii) leaching inhibitors (soaking seeds to remove chemicals).

(iv) Exposure of seeds to light

(v) Use of growth regulator

Seed banks

Seed banks are facilities that store seeds to preserve genetic diversity for future use, often in cold, dry conditions to ensure viability. They are a critical tool for safeguarding crops against threats like disease, environmental disasters, and climate change. There are different types, including large-scale global reserves like the Svalbard Global Seed Vault and smaller community seed banks that serve local farmers, which can also improve local food security and empower communities.

Importance of seed banks

(i) **Preserving Genetic Diversity:** Seed banks store seeds with a wide range of genetic traits, which are essential for plant breeders to develop new crop varieties that are more resistant to disease, drought, and pests.

(ii) **Safeguarding Against Catastrophe:** They act as a "backup" against global events like environmental disasters, wars, or climate change that could wipe out existing crops in the field.

(iii) **Supporting Food Security:** By preserving a wide variety of seeds, seed banks help ensure that future food security is not dependent on a narrow range of crops.

(iv) **Improving Local Agriculture:** Community seed banks can be particularly impactful, helping farmers access a wider range of seeds, learn new management techniques, and build stronger social cohesion.

How seed banking works

(i) **Collection:** Seeds are collected from various sources, including wild plants and diverse crop varieties.

(ii) **Preparation:** Collected seeds are cleaned, dried under controlled conditions, and tested for viability.

(iii) **Storage:** Seeds are stored in sealed containers in cold, dry vaults to maximize their lifespan.

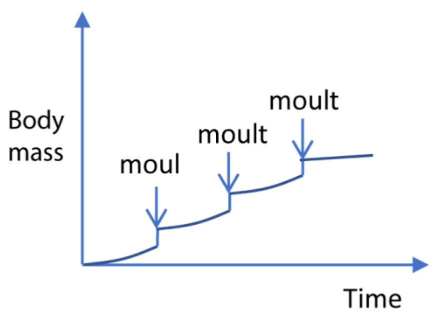
(iv) **Testing:** Seeds are periodically tested to ensure they remain viable for long-term storage.

(v) **Withdrawal:** Seeds **can** be withdrawn for planting or research purposes when needed.

Growth in arthropods

Due to inelastic nature of their exoskeletons, they appear to grow only in spurts interrupted by a series of moults. Significant growth is only possible when the new cuticle is still soft enough to allow the body to expand

Arthropod growth curve



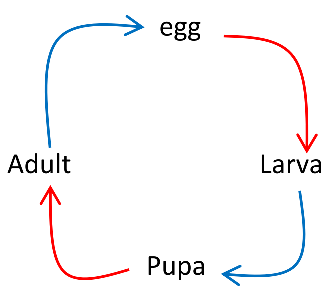
Moulting is controlled two main hormones: **moulting hormones (ecdysone)** and **juvenile hormone**. Moulting hormone is produced by gland in the first thoracic segment called **prothoracic gland**. Juvenile hormone is produced by a region behind the brain known as the **corpus allatum**. The production of both hormones is controlled by neurosecretory cells in the brain. All moults require moulting hormone. If juvenile hormone is present in high concentration larval moults occur, which means the insect remains as a larva.

Metamorphosis

Applies to those changes which occurs during the transition from larval to adult forms. It is very common in insect, frog and other amphibian's metamorphosis enable the different stage organism develops to fill different ecological niches which reduces competition.

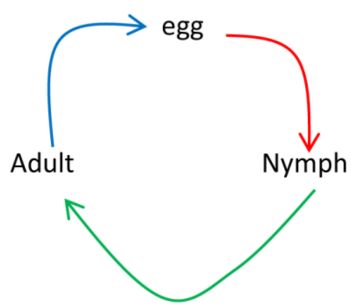
Complete metamorphosis

E.g. in butterfly



Incomplete metamorphosis

E.g. in cockroach



The role of insect growth stages in ecosystems

The developmental stages of insects play specialized roles in an ecosystem's functions, contributing significantly to waste management, food security, and water quality. Larvae, nymphs, and adults each interact differently with their environment to process waste, serve as food, and act as bioindicators.

The role of insect growth stages in Waste management

Different insect growth stages perform distinct roles in breaking down organic waste and recycling nutrients.

(i) **Larval and nymphal stages:** As detritivores, the immature stages of many insect species are the primary drivers of decomposition. They consume and fragment organic matter such as dead plants, carrion, and animal feces.

(ii) **Black soldier fly larvae (BSFL):** These larvae have a voracious appetite and are highly effective at converting massive amounts of food waste, manure, and agricultural byproducts into high-protein biomass and nutrient-rich fertilizer (frass). The commercial farming of BSFL is a low-impact and efficient method for large-scale biowaste treatment.

(iii) **Dung beetles:** Both adult and larval dung beetles feed on animal feces, recycling valuable nutrients and preventing nitrogen loss into the atmosphere. Their tunneling activity also aerates the soil, improving its structure and fertility.

(iv) **Blowflies and flesh flies:** The larvae of these flies, known as maggots, are among the first responders to decomposing animal carcasses, accelerating their breakdown and the recycling of nutrients.

(v) **Adult stage:** While adult decomposers are less active in direct consumption, they are crucial for reproduction and waste localization. For instance, adult blowflies seek out and lay eggs on decaying matter, initiating the decomposition process.

The role of insect growth stages in Food security

Insects are a highly efficient and sustainable source of protein that can be harvested or farmed, providing food and feed at multiple stages of their life cycle.

(i) **High conversion efficiency:** Because insects are cold-blooded, they are extremely efficient at converting feed into body mass compared to traditional livestock.

(ii) **Larval and pupal stages:** These stages are often the most nutrient-dense and harvested for consumption.

(iii) **Human food:** Edible insects like caterpillars, beetles, grasshoppers, and crickets are a traditional and increasingly popular food source for humans in many parts of the world, providing high-quality protein, fatty acids, and micronutrients like iron and zinc.

(iv) **Animal feed:** The larvae of species like the black soldier fly and mealworm are farmed commercially to produce protein-rich feed for poultry, fish, and other livestock. This provides a sustainable alternative to traditional feed ingredients like soy and fishmeal.

(v) **Adult stage:** Some species of adult insects, such as locusts and grasshoppers, are harvested and eaten. As pollinators, adult bees, wasps, and butterflies also indirectly contribute to food security by ensuring the reproduction of crops and wild plants.

The role of insect growth stages in Water quality assessment

Because they spend part or all of their lives in aquatic environments, many insects are sensitive bioindicators of water quality. Their presence, absence, or abundance can signal the level and type of pollution in a water body.

(i) **Larval stage:** The larval and nymphal stages of aquatic insects are especially useful for monitoring water quality because they are immobile and have varying levels of pollution tolerance.

(ii) **High-sensitivity bioindicators:** The larvae of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera), known collectively as EPTs, require clean, well-oxygenated water to survive. Their presence indicates good water quality, while their absence is a sign of pollution.

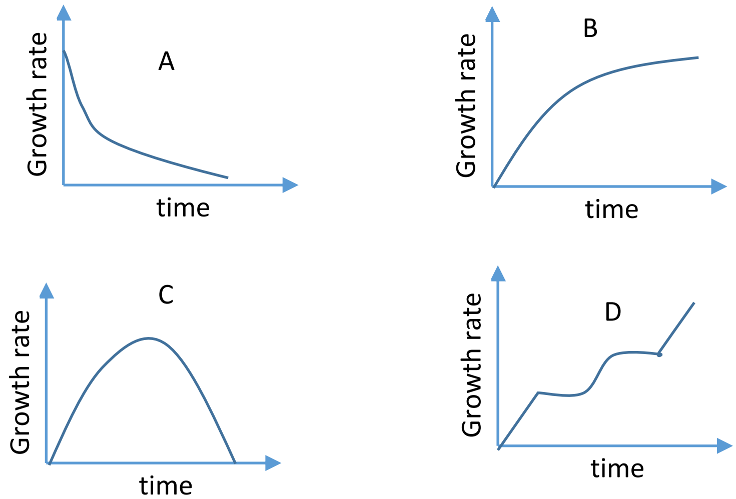
(iii) **Low-sensitivity bioindicators:** The larvae of midges (Chironomidae) and certain flies can tolerate low levels of dissolved oxygen and a range of pollutants. Their presence in high numbers, especially without EPTs, can indicate marginal to poor water quality.

(iv) **Specialized indicators:** Some insect larvae, like those of certain aquatic midges, have been found to ingest and expel microplastics, making them potential tools for assessing microplastic pollution in freshwater.

(v) **Adult stage:** While less direct, the health of adult insect populations (e.g., dragonflies) that emerge from a water body can reflect the long-term health of that aquatic ecosystem.

Revision Exercise

1. Which one of the following graphs in the figure below correctly represents the growth rate of multicellular organism?



C

2. Worker bees and queen bee are polymorphic forms which differ in fertility as a result of
   A. Feeding on different diet
   B. Worker's eggs not being fertilized
   C. Workers being produced parthenogenetically
   D. The queen having diploid cells while workers have haploid cells A
3. Worker bees are
   A. Sterile females developed from fertilized eggs
   B. Fertile male developed from unfertilized eggs
   C. Sterile females developed from unfertilized eggs
   D. Fertile female developed from unfertilized eggs A

5. Primary growth in plants is mainly the activity of

   A. lateral meristems.

   B. apical meristems.

   C. primary meristems.

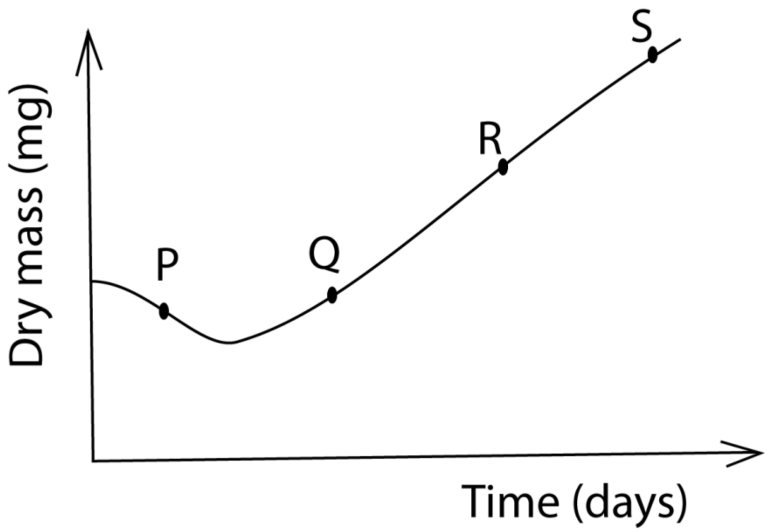
   D. intercalary meristems. B

6. .When are gibberellins formed in the germinating starchy seed?

   A. After water absorption.
   B. After production of amylase.

   C. When the radicle emerges.
   D. During the production of amylase. A

7. The figure below shows changes in mass of growing seedling with time



Which part of the curve indicates growth where respiration is higher than photosynthesis?

A. R
B. S
C. P
D. Q C

8. The significance of Etiolation in germinating seed in the soil is that is
   A. Leads to rapid elongation of the hypocotyl in monocotyledonous plant
   B. Allows maximum growth in length with minimum use of food reserves
   C. Allows seedlings to grow in the dark
   D. Ensure leaves remain small to break through the soil. B

9. The primary meristematic tissues in plant which gives rise to the cortex is the
   A. Ground meristem
   B. Procambium
   C. Protoderm
   D. Protoxylem A

10. In higher plants, the lateral roots originate from the
    A. Endodermis
    B. Epidermis
    C. Pericycle
    D. Cambium. C

Structural questions

11. (a) What is the role of apical meristem in root growth? (7marks)

Root apical meristem (RAM) performs the following roles in root growth

(i) **Primary Growth (Length Increase):** The RAM is the site of cell division (mitosis), creating new cells that elongate and push the root through the soil, thus increasing its overall length.

(ii) **Cell differentiation** gives rise to different kinds of root tissues

(iii) **Primary vascular tissue growth** contributes to increase in the girth of the root.

(iv) **Lignification** of xylem cells contributes to support.

(v) **Formation of distinct primary meristems**; **Protoderm (**Forms the outer protective layer, the epidermis (or rhizodermis in roots).), **Procambium (**Develops into the primary xylem and phloem, which are responsible for water and nutrient transport), **Ground Meristem (**Forms the cortex, which stores nutrients, and the endodermis, which regulates water movement into the vascular cylinder)

(vi) **Root Cap Formation:** The RAM produces the root cap, a protective layer of cells that shields the delicate meristem from abrasive soil particles as the root grows.

(vii) **Pericycle Development:** The procambium differentiates into the pericycle, which is crucial for the emergence of lateral roots.

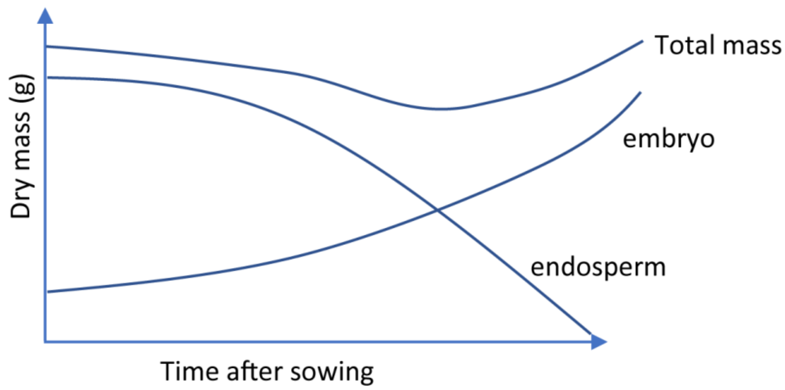
(viii) **Geotropism:** The RAM is sensitive to gravity, growing downwards (positive geotropism) to anchor the plant and seek water.

(b) Describe the formation of secondary tissues in dicotyledonous plant. (13marks)
Secondary tissue formation in dicotyledonous plant occurs by lateral meristems and leads to secondary growth or thickening
Lateral meristems include

(i) Vascular cambium
This divides into three layers of cells; the inner layer differentiates into secondary xylem; the outer layer into secondary phloem; while the inner layer remain meristematic. Phloem distributes manufactured food while the xylem transports water and provides mechanical support

(ii) Cork cambium/phellogen
Divides into three layers of cells; the inner differentiates into secondary cortex, the outer cork while the inner remain meristematic.

12. Figure 5 shows change in dry mass of the embryo, endosperm and total mass of maize seeds germinating in light condition.



(a) Explain the changes in relative dry mass of the

(i) endosperm

The dry mass of the endosperm decreases during germination because its stored nutrients, such as starches, proteins, and lipids, are **hydrolyzed into simpler compounds** (like glucose and amino acids) and **used for growth embryo and respiration**

(ii) embryo

The dry mass of an embryo increases during germination because it uses food reserves to cell division and growth. Later food from photosynthesis is also used.

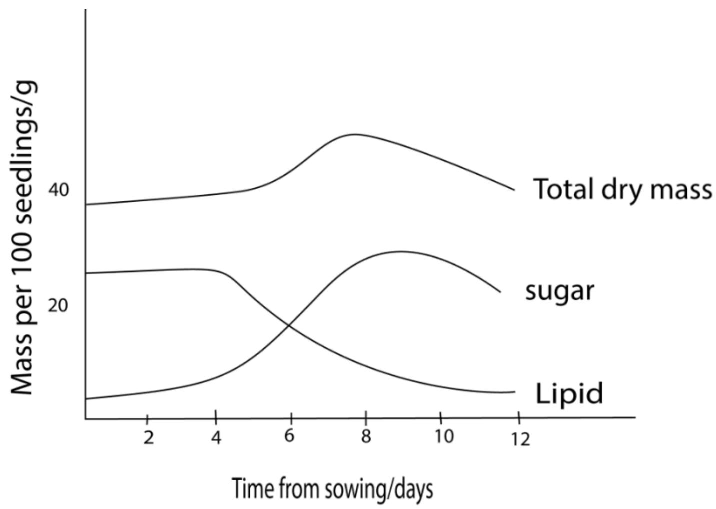
(b) Explain why the total dry mass of the seedling initially decreases then later increases

The initial decrease in the total dry mass is due to the respiration of food reserves from endosperm. Later, the total dry mass increases as the first foliage leaf emerges and starts to photosynthesize. The carbohydrate formed more than compensate for the respiration losses so that there is a net increase in total dry mass.

(c) Suggest with reason, what would happen to the total dry mass of seedling if the seeds were germinated in the dark

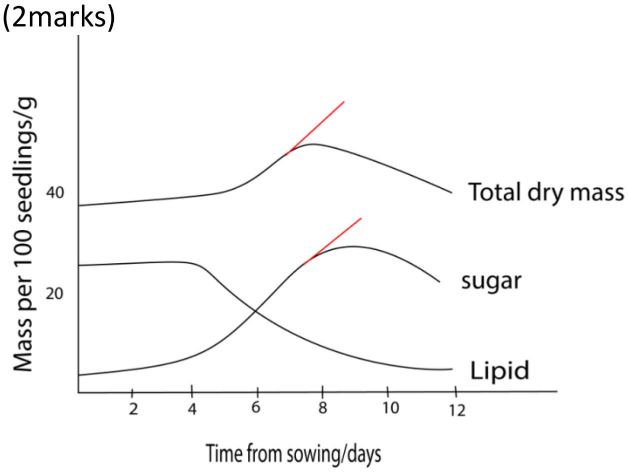
The total dry mass of the seedling would continue to decrease gradually until the seedling dies with no subsequent increases. This is because the food store would be depleted by respiration and no photosynthesis would occur in the dark compensate for the loss.

13. The graph below shows changes in lipids and sugar content of castor oil seeds during germination in the dark



(a) Explain the changes in lipid and sugar content and total dry mass during the experimental period.
- The main storage food reserve is lipid
- During germination, lipids decrease as they are broken down to fatty acids and glycerol
- The fatty acids are either used directly for respiration or are converted to sugars. The sugar content therefore rises.
- Sugar is translocated to the embryo
- The dry mass at day 6, because of assimilation of sugars to structural materials and growth occurs.
- Dry mass then fall because the lipids are exhausted and sugar decrease due to respiration

(b) On the same graph indicate the shape of the curves if the seeds were to germinate in light (2marks)



14. (a) describe how the following tissues bring about growth in higher plants

(i) Apical meristem

- Are found at the root and shoot apices
- Meristematic cells initially divide by mitosis.
- Some of the cells remain meristematic while others increase in size and differentiate to become permanent tissues.
- Apical meristems increase lengths of root and shoot by increasing the number and size of cells at apices.

(ii) Vascular meristems

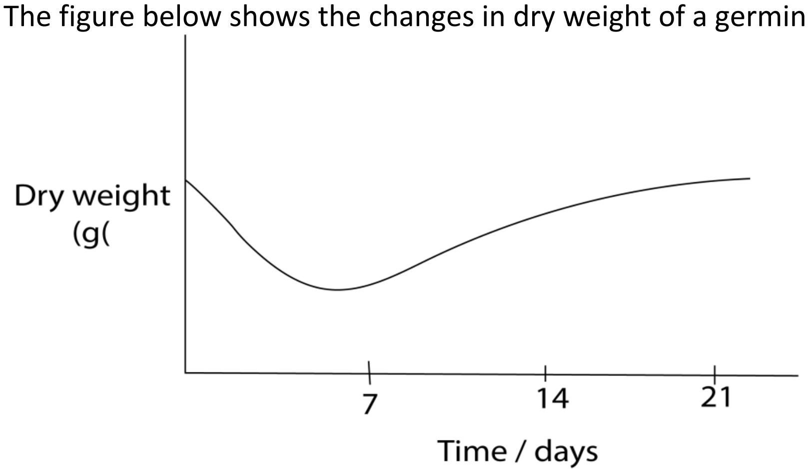
- A lateral meristem consist of two types of cells fusiform and ray initials
- Fusiform initials are elongated and divide by mitosis to form secondary phloem to the outside and secondary xylem on the inside. The amount of xylem produced normally exceeds the amount of phloem.
- Ray initials are spherical and divide by mitosis to form parenchyma cells which accumulate to form rays between the neighboring xylem and phloem

Successive divisions results in increase in the girth of the plant

(b) How does growth in mammals differ from that in flowering plants?

- Growth control factors in plants are sensitive to environmental factors such as sunlight and gravitation pull while that of mammals does not.
- Growth in plants is limited at the meristems while that of mammal occurs in all parts of the body

15. The figure below shows the changes in dry weight of a germinating bean seed



(a) explain the changes

(i) in the first seven (7) days

There is slow and then rapid decrease in dry weight due to respiration

(ii) between the seventh and 21 day

There is gradual increase in dry weight due to accumulation of sugars by photosynthesis.

(b) Give the major factors that cause seed dormancy

- hard impenetrable seed coat to water and oxygen
- immaturity of embryo
- presence of germination inhibitors
- unfavorable environment conditions

16. (a) Describe the physiological changes that occur in a seed during germination (10 marks)

- Germination starts with the rapid uptake of water by the seed through the micropyle by a process called ambition. Water then moves from cell by osmosis.
- The water causes swelling of the embryonic tissue thereby rapturing the seed coat and also activates gibberellins.
- Gibberellins diffuse to the aleurone layer whereby they cause the synthesis and activation of hydrolytic enzymes such as amylase and proteases.
- Amylase catalyzes the breakdown of starch to glucose while proteases catalyze hydrolysis of proteins to amino acids.
- Glucose and amino acids are translocated from the storage centre (endosperm or cotyledon) of the seed to the growing regions of the embryo.
- Here glucose is used in respiration and in the formation of cellulose and other cell wall materials. Amino acids are used to make proteins, which are enzymes and structural components of protoplasm.

(b) Giving reasons, suggest suitable conditions under which seeds for planting should be stored (06 marks)

- The suitable temperature for germination in most seeds is 25-30^{0}C. Thus seeds should be kept at a temperature below this in order to prevent germination in these seeds.
- Water is necessary for germination. Therefore, keeping seeds in a dry environment prevents germination and keeps the seed viable.
- Light is important for germination in most seeds and therefore keeping them in darkness prevents germination and keeps the seed viable.

(c). Even when supplied with suitable conditions for germination, some seeds remain dormant, explain the importance of dormancy in seeds. (04 marks)

Dormancy allows for seed dispersal.

- Seeds are able to survive unfavorable conditions like drought.

- Dormancy prevents seeds from germination in the pods.
- The low metabolic rate during dormancy enables seeds to stay viable for a long time.

18. (a) Describe structural characteristic of cells of meristematic tissues. (03 marks)

Characteristics of meristematic tissues include small cells, thin cell walls, large cell nuclei, absent or small vacuoles, and no intercellular spaces.

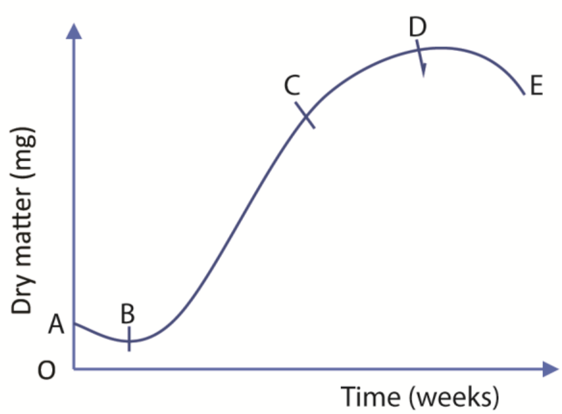
(b) Distinguish between apical and lateral meristems. (03 marks)

Apical meristem is the **meristematic** tissue at the tip of stem and roots, responsible for the primary growth or increase in length of the plant whereas **lateral meristem** is the **meristematic** tissue at the margins of roots and stems, which is responsible for the secondary growth or increase in girth of the plant.

(c) Describe structural adaptation of vascular tissues for support. (14marks)

- 1. Walls are lignified
- 2. Vessels are circular for additional support.

19. The figure below shows the accumulation of dry matter of bean plant measured at different stages of growth from plating up to harvesting time. Study the figure and answer the questions that follow**.**



(a) **Name the different stages**

(i) **A – B: lag phase/establishment stage**

(ii) **B – C: logarithmic stage/rapid growth stage**

(iii) **C – D: steady stage/maturation stage**

(iv) **D – E : decline stage/senescence**

(b) **State four physiological events that occur between A and B (04marks)**

- **Hydrolysis of storage food material**
- **Synthesis of enzymes, nucleic acids, structural proteins**
- **Respiration to provide energy for cellular activities**
- **Glucose** and amino acids are translocated from the storage centre (endosperm or cotyledon) of the seed to the growing regions of the embryo.

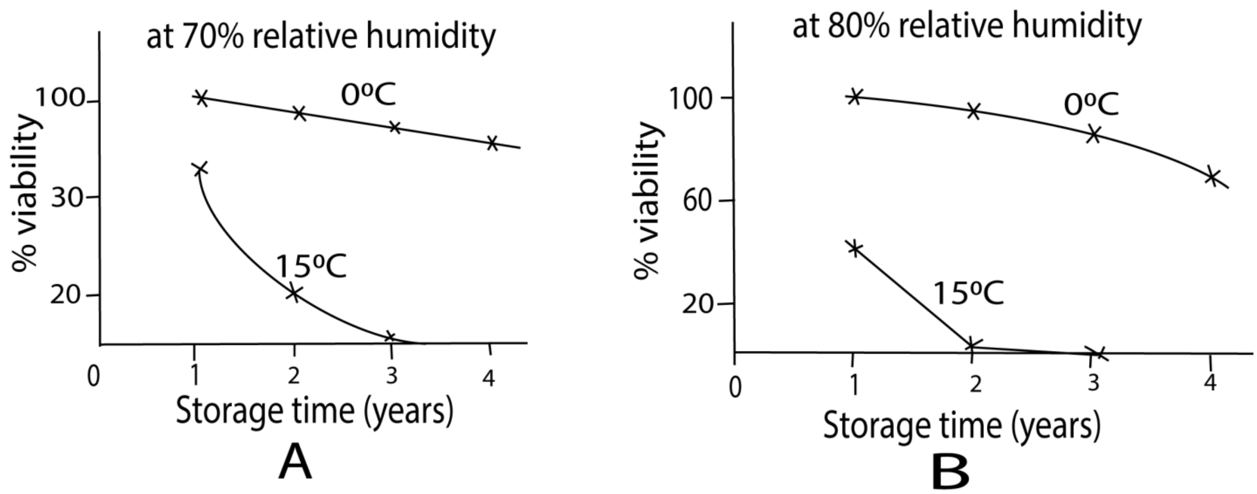
- Cell division, elongation and differentiation leads to immergence of a seedling from a seed.

(c) Account for rapid increase in dry matter yield between B and C (02marks)
- Rapid cell multiplication due to presence of many cells
- Absence of diseases and other environmental resistance.
- Absence of pollutants

(d) Suggest two causes of the decline in dry matter yield between A and E

High rate cell death caused
- Accumulation of waste/toxic materials in plant that inhibit growth
- Diseases
- Predators/parasite
- Lack of water towards dry season

Figure A and B below show viability of fescue grass seed at different conditions.



(a) From the figured state the factor that affect viability of fescue grass seed (1 ½ marks)
- humidity
- Temperature
- Storage time

(b) Describe the effect of each factor in (a) on the viability of seeds (03marks)
- The higher the humidity the faster the seeds lose viability
- The higher the temperature the faster the seeds lose viability
- The longer the seeds are stored, higher they lose viability

(c) Explain the effect of each factor in (a) on viability of seeds (5 ½ marks)

- high humidity lead to loss of seed viability because it promotes growth of moulds, infections and pests.
- High temperature lead to loss of viability it increases respiration and exhaustion food reserve. It also promotes moulds and pests.
- The longer the seed are stored, the more they lose viability due to increase in damage by pest and moulds.

44. (a) Explain what is meant by dormancy in seeds. (02marks)

(b) Describe the causes of dormancy

(c) Explain why dormancy is more common in weeds than in tropical forest trees (08marks)

Thank you Dr. Bbosa Science