Plant Growth and Development

Introduction

- Growth is defined as **Permanent and Irreversible Change** in the size or volume of cell organ or whole organism, usually accompanied by an **increase** in **fresh** or **dry weight**.
- Growth is a **Biological Reaction**, occurring in protoplasm of all living cells.
- Growth is a basic feature of all living organisms.
- Growth is **Diffused in Animals,** but in **Plants Growth is Localised & Irregular** (nail insertad in plant stem, occupies same height till several years of growth).

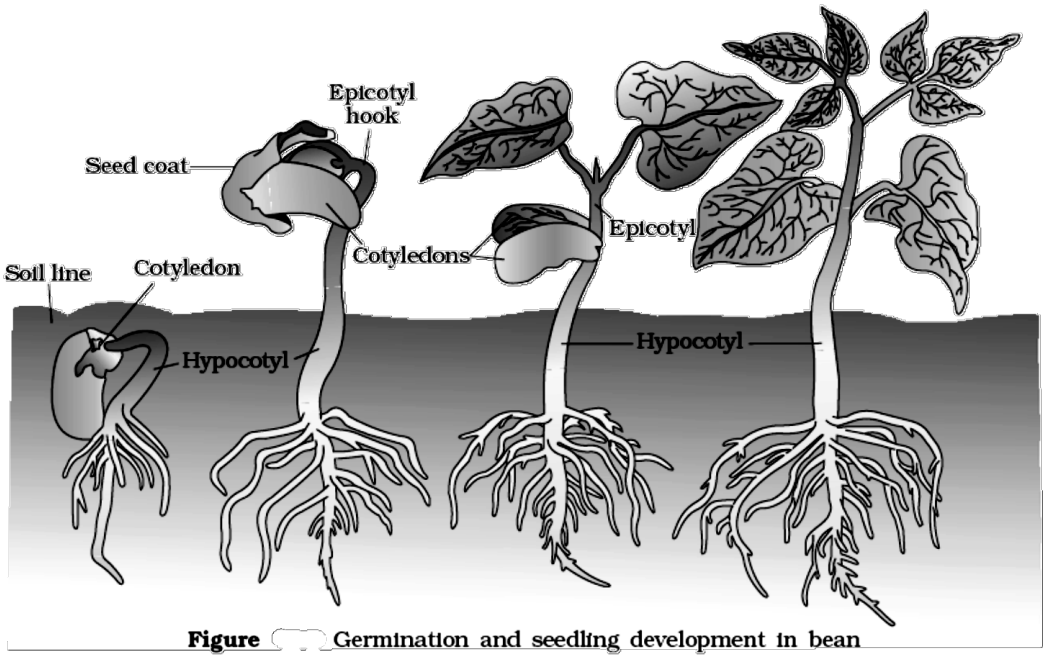
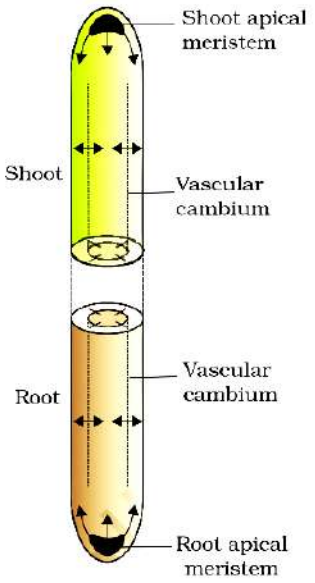


Figure Germination and seedling development in bean

Plant Growth Generally is Indeterminate

Plant growth is unique because plants retain the capacity for unlimited growth throughout their life. This ability of the plants is due to the presence of meristems at certain locations in their body. The cells of such meristems have the capacity to divide and self-perpetuate. The product, however, soon loses the capacity to divide and such cells make up the plant body. This form of growth wherein new cells are always being added to the plant body by the activity of the meristem is called the open form of growth.



- Limited/Determinate growth - In annuals & biennials. Growth activities are restricted for a determined period of time.
- Unlimited/Indeterminate growth - In perennials. Growth activities occurs through out the life.

Growth is Measurable:

Basis of Growth:

- Increase in number of cells
- Increase in fresh & dry weight
- Increase in volume and area of fruits and leaves
- Increase in length of roots and shoot – This is the general basis for growth measurement.

Phases of Growth:

- The period of growth is generally divided into three phases, namely, **meristematic, elongation** and **maturation.**
- Let us understand this by looking at the root tips. The constantly dividing cells, both at the root apex and the shoot apex, represent the meristematic phase of growth.
- The cells in this region are rich in protoplasm, possess large conspicuous nuclei. Their cell walls are primary in nature, thin and cellulosic with abundant plasmodesmatal connections.
- The cells proximal (just next, away from the tip) to the meristematic zone represent the phase of elongation. Increased vacuolation, cell enlargement and new cell wall deposition are the characteristics of the cells in this phase.
- Further away from the apex, i.e., more proximal to the phase of elongation, lies the portion of axis which is undergoing the phase of maturation. The cells of this zone, attain their maximal size in terms of wall thickening and protoplasmic modifications.

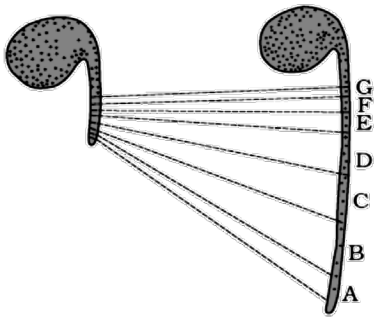


Figure Detection of zones of elongation by the parallel line technique. Zones A, B, C, D immediately behind the apex have elongated most.

Growth Rate:

Increase in growth per unit time. Plant growth is of two types :

(A) Arithmetic Growth: From a dividing cell, two new cells are formed (by mitotic division) out of them one daughter cell continues to divide while other differentiate and or become mature cell (stop dividing).

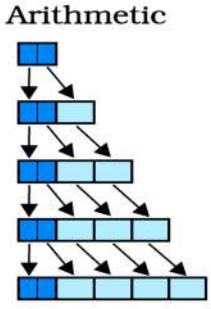
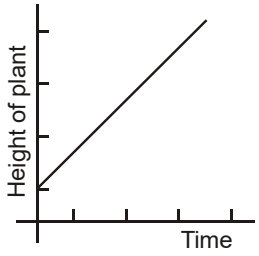


Fig. Arithmetic growth

Ex. **Root** & **Shoot elongation** at constant rate.



- Its curve is **linear**
- It is mathematically expressed as

$L_t = L_0 + rt$ where L_t - length at time 't'

L_0 - length at time 'zero'

r - growth rate / elongation per unit time.

(B) Geometric/Exponential Growth: From dividing cell (by mitotic division) both daughter cells retain the ability to divide and continue to do so.

Ex. All cells, **tissue**, **organs**, **developing seed**, **germinating seed**, **seasonal activities** etc.

Its curve is **sigmoid**

It is mathematically represented as

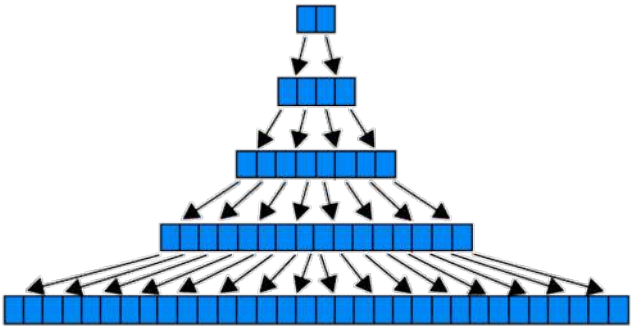
$W_1 = W_0 e^{rt}$

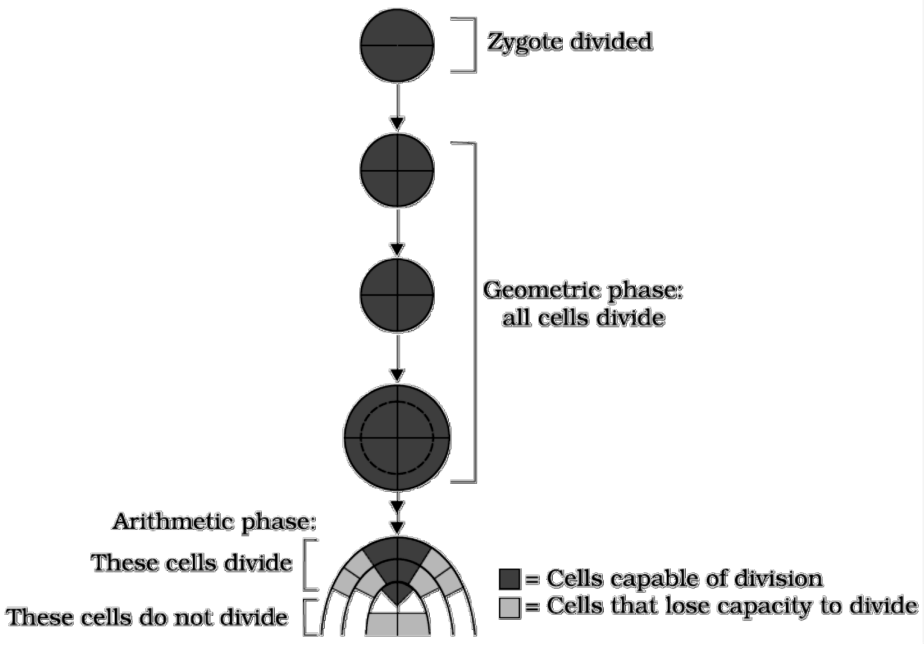
Where W_1 - final size (Weight, height, number etc.)

W_0 - initial size at the beginning of period.

r - growth rate

e - base of natural logarithms.



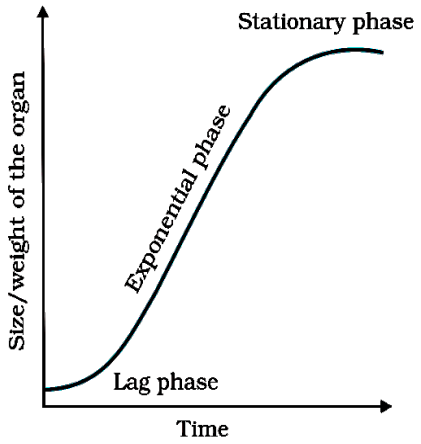


- If rate of growth of a plant is plotted against time, a **'S'** shaped curve is obtained. This is known as **sigmoid curve**.
- So, growth curve is the graphic representation of the total growth against time.
- Sigmoid curve or total time period can be divided into **three phases:** –

(I) Lag Phase

(II) Log Phase

(III) Stationary or Steady Phase



What kind of a curve can you expect in a tree showing seasonal activities?

(I) Lag Phase:

- It is initial phase of slow growth.
- It is a phase of formation of cells.

(II) Log Phase:

- It is middle phase of rapid growth
- Growth increases rapidly to a maximum during elongation phase.
- It represents **grand period of growth.**

(III) Stationary or Steady Phase:

- Finally rate of growth becomes almost zero.

Growth Activities and Phases of Growth:

- **Cell division or cell formation:** Number of cells increases by cell division.
- **Cell enlargement or cell elongation:** Size of cells increases due to **vacuolization** & T.P. (turgor pressure).
- **Cell maturation or differentiation phase:** (Also called as **morphogenetic, organogenic** or differentiation phase) Development or qualitative change is important feature of this phase.
- Growth in size or weight of a specific part in a definite time is known as rate of growth.
- Rate of growth is not uniform. In all parts of a plant, rate of growth in initial stages is more, then it increases more, becomes slow and finally stops.

(C) Absolute and Relative Growth Rates:

Absolute Growth Rate : Measurement and the comparision of total growth per unit time in plant or plant parts.

or

Total growth occurs in unit time in plant or plant parts.

Relative Growth Rate: The growth of the given system per unit time expressed in a common basis i.e., per unit initial parameter in plant parts.

$$\text{Relative growth} = \frac{\text{New growth}}{\text{Old size}} \times 100$$

or

Total growth occurs in unit time in comparison to initial growth in plant or plant parts. Relative growth rate is generally high in young developing plant parts.

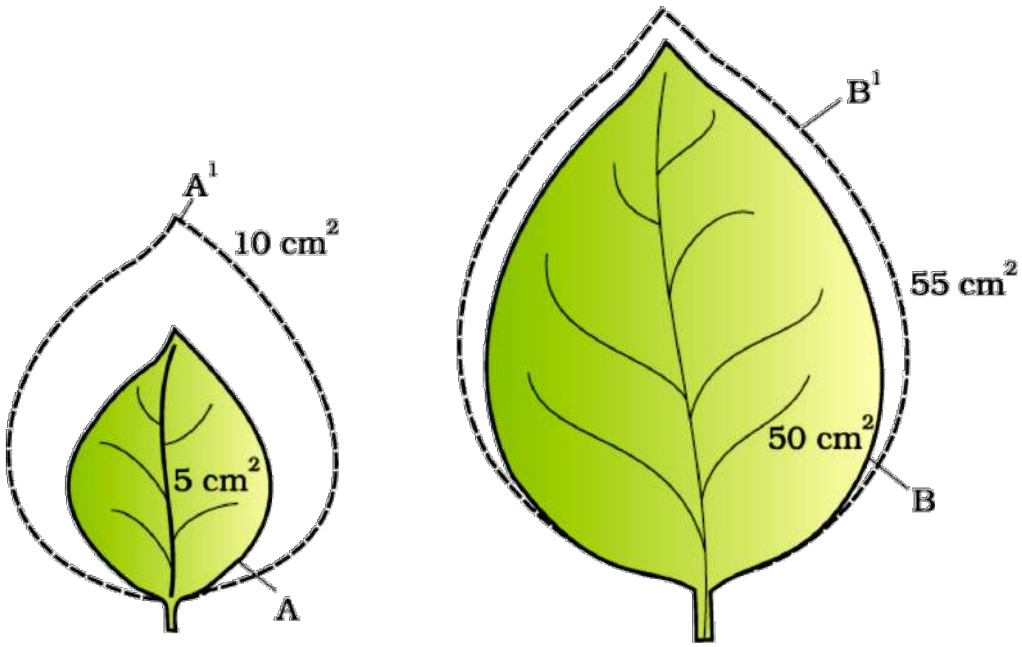


Fig. Diagrammatic comparison of absolute and relative growth rates. Both leaves A and B have increased their area by 5 cm2 in a given time to produce A1, B1 leaves.

- But high relative growth rate in leaf 'A' about 100%, while in leaf 'B' it is about 25%.

Differentiation, Dedifferentiation and Redifferentiation

Differentiation:-

- The cells derived from root apical, shoot apical meristems and cambium differentiate and mature to perform specific functions. **This act leading to maturation is termed as differentiation.**
- During differentiation cells undergo a few to major **structural changes both in their cell walls** and **protoplasms.**

  Example:- To form a tracheary element, the cells would lose their protoplasm. They also develop a very strong, elastic lignocellulosic secondary cell walls, to carry water to long distances under extreme tension.

  Dedifferentiation:- The living differentiated cells, that by now have lost the capacity to divide can regain the capacity of division under certain conditions. This phenomenon is termed as **dedifferentiation.**

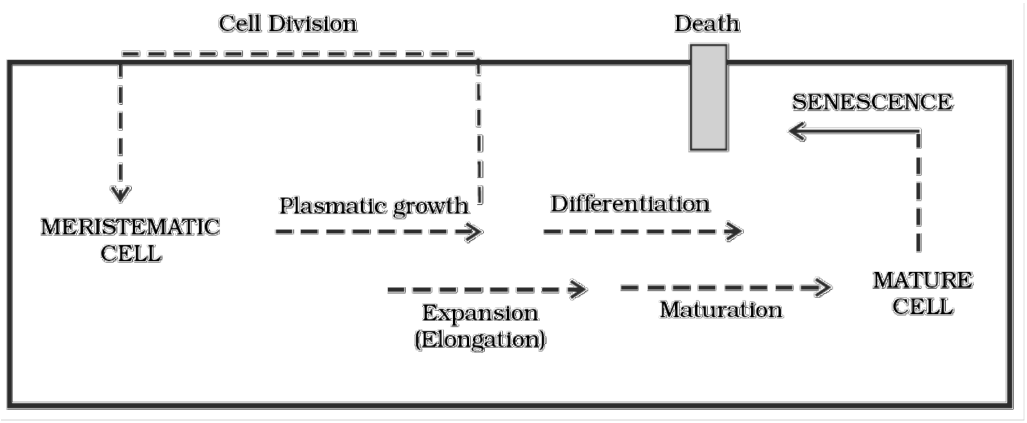
Example:- Formation of secondary meristems (interfascicular cambium and cork cambium) from fully differentiated parenchyma cells.

Redifferentiation:- Cells of secondary meristems are able to divide and produce cells that once again lose the capacity to divide but mature to perform specific functions. Such cells are called redifferentiated cells and the phenomenon is termed as **redifferentiation.**

List of tissues in a woody dicotyledonous plant that are the products of redifferention :-

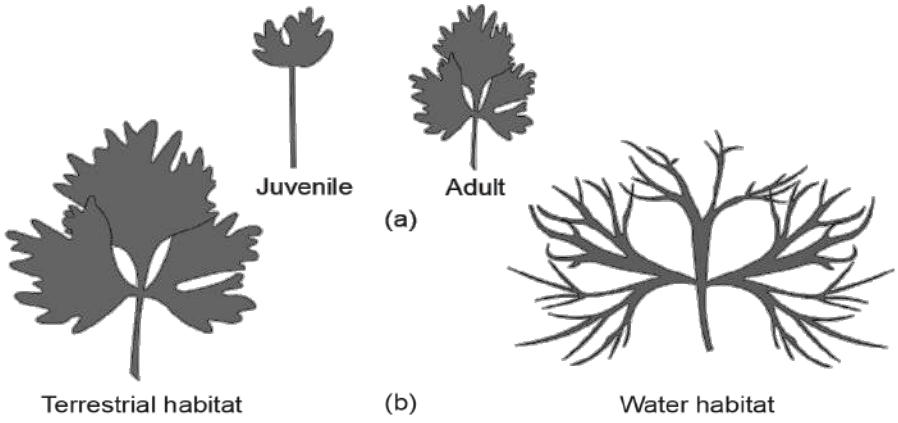
- Secondary xylem
- Secondary phloem
- Cork of phellem
- Secondary cortex or phelloderm

Development



Sequence of the developmental process in a plant cell

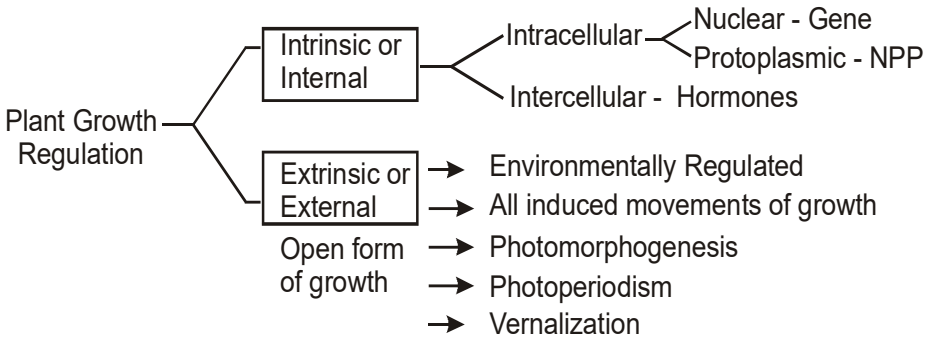
- Plant follow different pathways in response to environment or phases of life to form different kind of structures. This ability is called plasticity. e.g. heterophylly in cotton, Coriander and larkspur. In such plants the leaves of the young plant are different in shape from those in mature plants.
- On the other hand, difference in shapes of leaves produced in air and those produced in water in buttercup also represent the heterophyllous development due to environment. This phenomenon of heterophylly is an example of plasticity.



Heterophyll in (a) Larkspur and (b) buttercup

Factors Affecting Growth / Regulation of plant growth / Condition for Growth

- Growth differentiation and development are very closely related events in the life of a plant. Broadly, development is considered as the sum of growth and differentiation.
- Growth is affected by **external** and **internal** factors –



Concept Builder

1. The first step in the process of plant growth is :

(1) Seed germination (2) Root formation (3) Shoot formation (4) Cotyledon formation

2. Growth is :

(1) Change in size (2) Irreversible changes

(3) Expansion of leaf size (4) All the above

3. Phases of growth is :

(1) Meristematic phase (2) Elongation phase

(3) Maturation phase (4) All the above

4. Mathematically represented arithmetic growth rate :

(1) $W_1 = W_0 e^{rt}$ (2) $L_t = L_0 + rt$ (3) $L = L_0 - rt$ (4) $w_1 = w_0 + e^{rt}$

5. Heterophylly development due to environmental changes is found in :

(1) Butter cup (2) *Ranunculus*

(3) *Delphinium* & *Gossypium* (4) All except (3)

Concept Builder (Answer-Key)					
Que.	**1**	**2**	**3**	**4**	**5**
Ans.	1	4	4	2	4

Growth Regulators

Growth is mainly regulated by small amount of chemical substances present at growth points in plants.

These are known as **Growth regulators** or **Growth hormones**.

- Growth regulators are of two types -

(a) Growth Promoters:

- Those hormones which increases the rate of growth are called **growth promoters**.

  Auxin: Indole-3 Acetic acid

  Gibberellin: Terpenes

  Cytokinin : N^{16}-Furfuryl amino purine (Adenine derivative)

(b) Growth Inhibitors : Growth Activities Inhibiter

ABA : Carotenoids

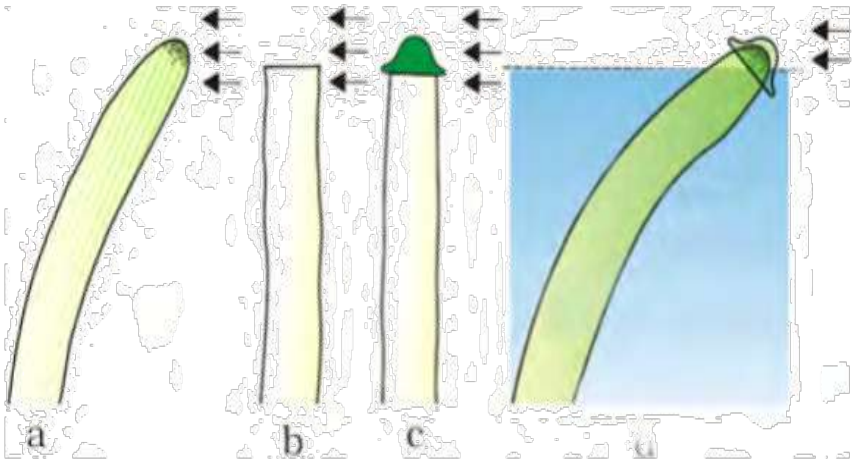
Ethylene : Gases

Auxin

History :

(A) Charles Darwin & Francis Darwin (1887) :

- They reported the presence of first growth hormone in the **coleoptile** tip of canary grass **(*Phalaris canarensis*).**
- They described the effect of **light** on curvature in coleoptile.
- **Darwin** reported that coleoptile tip of canary grass bend towards light. Thus it shows phototropism.



Introduction of Auxin:

- **Precursor** = Tryptophan {'**Zn**' is essential for biosynthesis}
- **Biosynthesis** = Shoot and Root apex
- **Transportation** = Polar and Basipetal, By parenchyma cells.

Physiological Effects and Applications of Auxin:

(i) It promotes cells elongation and also plays role in plant organ development (Morphogenesis).

(ii) Apical dominance: The phenomenon, in which apical bud dominates over the growth of lateral buds is called apical dominance, Pruning or decapitation in garden promotes densing of hedge and also used in tea plantation.

(iii) Root initiation : Rooting on stem cuttings is promoted by IBA & NAA so widely used for plant propagation.

(iv) Potato dormancy: MH (Maleic - Hydrazide),α-NAA, induces dormancy of lateral buds in potato tubers & potato can stored for long duration.

(v) Prevention of abscission: IAA, NAA prevents premature abscission of plant organs and promotes the same in old forms.

(vi) Parthenocarpy: Seed less fruits can be produced by spray of IAA (Solanaceae and Cucurbitaceae). e.g. Tomatoes.

(vii) Control xylem differentiation and helps in cell division

(viii) **Phototropism:** Curvature towards light.

(ix) Selective weed killer = Dicots weeds/broad leaf weed killer = 2, 4-D and 2, 4-5-T. (**Dioxin/Agent orange/Jungle defoliant)**

Does not affect monocot plants.

- **Bioassay** = **Bioassay means the testing of substance for it's activity in causing a growth response in a living plant or it's parts.**

  e.g. : Avena Curvature test.

Gibberellin (GA)

History :

- Japanese farmers noted that some plants in rice fields were taller, thinner and paler than the normal plants and named this disease as **'bakanae disease or foolish seedling disease'**.
- **Kurosawa** and **Swada** (1926) reported that this disease was due to a fungus ***Gibberella fujikuroi*** (Ascomycetes) whose incomplete state is ***Fusarium moniliformae*** (Duteromycetes).
- **Yabuta**, **Sumuki** and **Hyashi** (1938) isolated gibberellin from this fungus and named it as **Gibberellic acid**. It was **GA_3**.
- More than 100 types of gibberellins (GA_1, GA_2, GA_3.....) are known.

Introduction of Gibberellin:

- **Precursor** = Acetyl-CoA {By Mevalonic acid Pathway} / Kaurene.
- **Biosynthesis** = Germinating seed, Bud, Shoot, Root, Leaves.
- **Transports** = Non Polar, By xylem and phloem.

Physiological effects and application of GA:

- Elongation of genetic dwarf plant.
  Ex.: Pisum, Vicia, Maize, Sugarbeet.
- **Bolting effect :** Elimination of rosette growth in cabbage.
- Increase malting in sugarcane.

- **Stem and internode elonga**
- **Seed germination** → Breaking seed dormancy; Germination of photoblastic seeds, Ex. Lettuce, Tobacco
- Increase activity of stored food hydrolysing enzymes like Amylase, Lipase, Protease.
- Increase the size of grape bunch (by increasing length of a stalk).
- In brewing industry (wine production industry) : speed up the malting process.
- Increases height of sugarcane plant.
- Spraying juvenile conifer with GA hastens the maturity period, thus leading to early seed production.
- Gibberellins, cause fruits like apple to elongate and improve its shape.
- Pomalin (Apple enlarger) = mixture of GA (GA_4 and GA_7) + Cytokinin
- They also delay senescence. Thus, the fruits can be left on the tree longer so as to extend the market period.

  Bioassay = **(i) α-amylase activity test in Barley endosperm.**

  (ii) Dwarf pea and Maize test.

Cytokinin

History :

- **Skoog & Miller** (1956) first isolated them from **herring fish sperm DNA** and named them as **kinetin**.
- **Letham** (1953) isolated and characterised a cytokinin called **zeatin** from **immature maize kernels**.**(corn grain oil)**
- Kinetin does not occur naturally in plants, cytokinin like activities lead to the isolation of zeatin from corn-kernel's and coconut milk.

Introduction of Cytokinin:

- **Cytokinins are** Adenine derivatives.
- **Biosynthesis -** Root and shoot apex, young fruits
- **Transport -** Polar and Basipetal, By xylem.

Physiological Effects and Applications of Cytokinins:

- **Cell Division and Morphogenesis :**

  → Increase cell division in culture medium.

  → Morphogenesis in culture medium.

  $\frac{\text{Low CK}}{\text{High Auxin}}$ = Shoot, = Root, $\frac{\text{High CK}}{\text{Low Auxin}}$

- **Promotes growth of lateral branches and Adventitious shoot formation.** This function is antagonistic to apical dominance cased by auxin.
- **Nutrients Mobilisation and delayed Senescence. Richmond Lang effect.**
- Overcome the apical dominance.
- **Stomatal opening.**
- **Bioassay - (i) Chlorophyll preservation test.**

  (ii) Tobacco pith cell division test.

Concept Builder

1. Which group is **correct** for the growth promoter hormones ?

(1) Auxin, GA, ABA (2) IAA, GA, CK (3) IAA, ethylene (4) GA, ethylene, CK

2. Growth inhibitor plant hormones are :

(1) ABA, Ethylene (2) GA, CK (3) IAA, ABA (4) CK, ABA

3. Auxin was first isolated from :

(1) Human urine (2) Avena sativa (3) Rice plant (4) Coconut

4. Which hormones is responsible for apical dominance ?

(1) GA (2) CK (3) ABA (4) IAA

5. Which hormone is widely applied in tea plantations and hedge-making ?

(1) IAA (2) CK (3) Ethylene (4) GA

6. Parthenocarpy is induced by :

(1) CK (2) Ethylene (3) Auxin (4) ABA

7. What is the cause of "Bakane" disease ?

(1) Bacteria (2) Algae (3) Fungi (4) Virus

8. Function of GA is –

(1) Internode elongation

(2) Sped up the malting process

(3) Delay senescence for prolong fruiting on trees

(4) All the above

9. Cytokinin hormone is discovered by :

(1) F. Skoog & Miller (2) Kurosava (3) F. Went (4) Darwin

10. Cytokinin is responsible for :

(1) Produced new leaves (2) Lateral shoot growth

(3) Overcome the apical dominance (4) All the above

11. 2, 4-D herbicide is widely used to defoliate

(1) Monocotyledonous (2) Dicotyledonous (3) Gymnosperms (4) Both (1) & (2)

Concept Builder (Answer-Key)

Que.	1	2	3	4	5	6	7	8	9	10	11
Ans.	2	1	1	4	2	3	3	4	1	4	2

Abscisic Acid/ABA

History :

- **First Growth Inhibitor** was identified by Bennet-Clark and Kefford (1953) from dormant potato tuber and called it **β-inhibitor**.
- **Addicott and Okhuma (1963)** obtained from mature **Cotton fruits** and named as **Abscisin II.**
- **Waring and Robinson -** Isolated a growth inhibitor from old Betula leaves and called it **Dormin**.
- Later established that β-inhibitor, Abscisin-II and Dormin are same and called as Abscisic acid.

Introduction of ABA:

- **Precursor** - **Oxidation of β-carotene**.
- **Biosynthesis -** In any plants part where required.
- **Transpotation -** Not transported
- ABA also known as stress hormone, because it protects plants from adverse conditions like water stress. ABA increases tolerance of plants to various type of stresses**.**

Physiological Effects and Applications of ABA:

- **Regulates abscission and senescence**
  - Inhibits cells division and cell elongation.
  - Increase activity of polysaccharides hydrolysing enzymes, pectinase, cellulase.
- Induces bud and seed dormancy : ABA regulates (anti-GA) bud and seed dormancy.
  ABA plays a major role in seed maturation enabling seeds to become dormant.
- **Stomatal Closing** : ABA causes the stomatal closing under the water stress conditions (Antitranspirant).
- Inhibition of cell division & cell elongation.
- ABA acts as an antagonist to GAs
- ABA helps seeds to with stand desiccation and other factors unfavorable for growth.

Ethylene

History :

- **H.H. Cousin** (1910) first suggested that ripened oranges are responsible for ripening of unripen bananas.
- Ethylene is a **gaseous (volatile)** plant hormone.

Introduction of Ethylene:

- **Precursor - Methionine.**
- **Biosynthesis -** Ripening fruits, Senescent plant parts. Roots, Shoots,
- **Transport – Diffusion**

Physiological Effects and Applications of Ethylene:

- **Fruit Ripening** = Maximum synthesis of ethylene occurs in fruits, Respiration rate is increased and it's termed as Climacteric respiration.
  Artificial fruit ripening by - Ethephone / CEPA (2-Chloroethyl phosphoric acid) used.

- **Stimulates senescence and abscission of plant organs (Leaves & Flowers)**
- **Flowering and synchronising fruit set in pineapple and flowering in Mango.**
- **Triple Response on Stem :** (i) Apical hook formation in dicot seedling.
  (ii) Stimulation of radial swelling of stem.
  (iii) Horizontal growth of stem.
- Ethylene promote root growth and stimulates the formation of root hairs (Increase absorption surface)
- **Flowering - Femaleness -** In *Bromeliaceae* (Pineapple, Litchi) and Cucurbitaceae yield is increased.
- Thinning of cotton, cherry and walnut.
- Promotes rapid internode/petiole elongation in deep water rice seedlings.
- Breaking the dormancy: Initiate germination in peanut seeds and sprouting of potato tubers.

Concept Builder

1. One of the most widely used PGR in agriculture is :
(1) IAA (2) GA (3) Ethylene (4) CK

2. Gaseous PGR is :
(1) Auxin (2) GA (3) CK (4) Ethylene

3. Which PGA is used to initiate flowering and synchronising fruit set in Pineapples ?
(1) GA (2) CK (3) Ethylene (4) ABA

4. Which hormone is responsible for fruits ripening ?
(1) Ethylene (2) IAA (3) GA (4) CK

5. ABA acts as mainly an antagonist of :
(1) CK (2) Auxin (3) GA (4) Ethylene

6. Which hormone is responsible for stomatal closing ?
(1) ABA (2) CK (3) GA (4) ABA

7. Functions of ABA hormones :
(1) Provide tolerance to plants to various kinds of stresses
(2) Induces stomatal closing
(3) Play important role in seed development
(4) All the above

Concept Builder (Answer-Key)							
Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Ans.	3	4	3	1	3	4	4

Abscission:

- Detachment of senescent or mature plant organs like leaves, fruits, flowers due to change in hormonal activity.
- There is a separation layer **(abscission layer)** formed within the region of attachment of these parts. Cell wall layers and middle lamella are dissolved by the activity of **cellulase** and **pectinase** (Polysaccharide hydrolysing enzymes) during **abscission.**
- Hormone **ABA and Ethylene are main controller** of abscission process.

Plant Senescence:

- Period from reproductive maturity to degradative changes during the death of an organ or plant is known as **Senescence.**
- During senescence a gradual destruction occurs in protoplasm, cell, tissue, organ or plant and functioning of the plant and plant parts.
- During the senescence, higher rate of catabolism starts, under the control of growth hormones like **ABA, ethylene.** Senescence occurs as a result of ageing and leads to death of plant parts or whole plant.

Photoperiodism:

- The relative length of day and night is called **photoperiod.**
- The response of plants to the photoperiod, expressed in the form of flowering is called as **Photoperiodism.** "Effect or requirement of relative length of day **(photoperiod)** & night **(dark phase)** on flowering of plants is called as **Photoperiodism.**"
- The phenomenon of photoperiodism was first discovered by **Garner & Allard.** They experimented on **Maryland mammoth** (a mutant variety of **tobacco**), They studied the **Biloxy soyabean**.
- **Garner** & **Allard** classified the plants in following groups.

(1) SDP (Short Day Plants) : "These plants give flowers on exposure to photoperiod **equal** or **shorter than their critical day length."**

- They need a continuous (uninterrupted) dark period for flowering. Thus SDP also called as **LNP (Long Night Plants).**
- Example of SDP :- **Tobacco, Soyabean, Viola, Xanthium (Cocklebur), Chrysanthemum, Cannabis, Coleus, Chenopodium, Mustard, Dahlia, Sugarcane, Strawberry, Cosmos, Rice etc.**
- In SDP the **dark period is critical** and **must be continuous.** If this dark period is broken by a brief exposure to red light, then SDP will not flowers.
- Maximum inhibition of flowering with red light occurs at about the middle of critical dark period.
- Prolongation of the continuous dark period, initiates early & good flowering in SDP.

(2) LDP (Long Day Plants) : "These plants flowers only when they exposed to critical photoperiod or photoperiod longer than their critical day length".

The **light period is critical for LDP.**

Ex.: **Henbane** (Hyoscyamus) **Spinach, Sugar beet, Radish, Carrot, Wheat, Larkspur, Barley, Avena, Potato.**

- A brief exposure of red light in the dark period stimulates flowering in LDP.

(3) DNP (Day Neutral Plants) or Intermediate Plants : These plants do not need specific critical day length for the flowering. Ex. **Zea, Cotton, Tomato, Sunflower, Cucumber.**

- Stimulation of critical photoperiod is precepted by **leaves**.
- **"Florigen"**. It has been not isolated, thus called as **Hypothetical hormone.**

Phytochrome :

- Pigment responsible for photoperiodism, present in leaves.
- Phytochrome :- exists in two different forms

  Pr (Phytochrome red) - Red light absorbing from**, stable** form, **Physiologically inactive,** induce **flowering in SDP,** inhibits flowering in LDP.
- **Pfr (Phytochrome far red) -** This is **far-red light absorbing** form**, unstable** form, **Physiologically active** form, induce **flowering in LDP,** inhibits flowering in SDP.
- Both forms of phytochrome photo biochemically show **photochromicity** and **interconvertibility.**

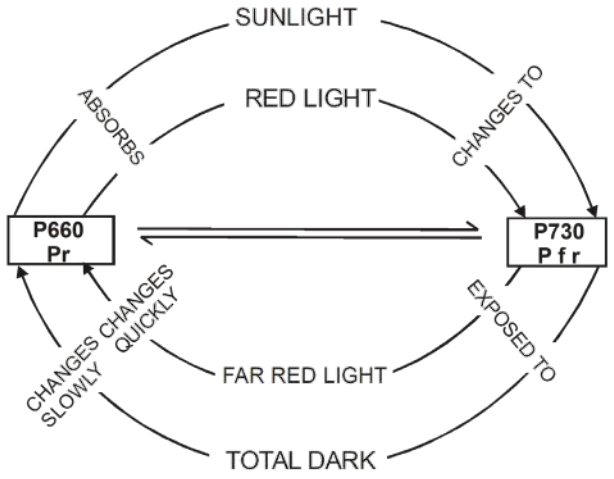


Fig.: The Phytochrome concept

- In SDP, during critical dark period, P_{fr} form gradually changes into P_r form which results in flowering.
- If critical dark period is interrupted by red light for short duration then P_r form is again converted to P_{fr} form, thus inhibiting flowering.
- The **inhibitory** effect can be **reversed** by subsequent far red light exposure.
- In SDP, whether flowering will be promoted or inhibited will **depend** on the exposure given in the last when the two types of radiations (Red and far red) are given **successively** –

  SDP + R $\rightarrow$ Inhibits flowering

  SDP + R + FR $\rightarrow$ Promotes flowering

  SDP + R + FR + R $\rightarrow$ Inhibits flowering
- In LDP, **prolongation** of light period or interruption of dark period by red light result in **accumulation** of P_{fr} form which stimulates flowering.

- P_{fr} form is biologically active form which is responsible to initiate a number of physiological process such as -

  (a) Seed germination (b) Photoperiodism

  (c) Stomatal opening & closing (d) Photomorphogenesis

Vernalization :

- Effect of low temperature on the initiation and development of flower, was first realised by **Klippart 1857** (Experiment on winter & $\rightleftharpoons$ Spring wheat)
- Detail study and term - **"Vernalisation"** by **Lysenko**.
- **Acceleration of ability to produce flower by chilling treatment is called vernalisation.**
- Mainly **embryo tip, shoot apex and leaves percept** induction of low temperature on plants.
- Vernalin is formed in response of vernalization, this is a **hypothetical plant hormone,** because not has been isolated till today.
- Vernalisation of **seeds or plant propagule** in laboratory can be induced at 1ºC to 10ºC in presence of O_2 and H_2O. Proper photoperiodic induction is also required after vernalization.
- If vernalized plant propagules are kept in high temperature, just after the low temperature treatment then effect of vernalization is reverse, this effect is called as **devernalization.**

Significance :

(i) Better and early flowering

(ii) Protects natural precocious reproductive development.

Seed Dormancy :

There are certain seeds which fail to germinate even when external conditions are favorable. Such seeds are understood to be undergoing a period of dormancy which is controlled not by external environment but are under endogenous control or conditions within the seed itself. Impermeable and hard seed coat; presence of chemical inhibitors such as abscisic acids, phenolic acids, para-ascorbic acid; and immature embryos are some of the reasons which causes seed dormancy.

Method to Break Dormancy :

This dormancy however can be overcome through natural means and various other man-made measures. For example, the seed coat barrier in some seeds can be broken by mechanical abrasions using knives, sandpaper, etc. or vigorous shaking. In nature, these abrasions are caused by microbial action, and passage through digestive tract of animals. Effect of inhibitory substances can be removed by subjecting the seeds to chilling conditions or by application of certain chemicals like gibberellic acid and nitrates. Changing the environmental conditions, such as light and temperature are other methods to overcome seed dormancy.

Exercise - I

1. Avena coleoptile test to find out the quantity of growth promoting hormones was discovered by –

(1) F,W, Went (2) L.J. Oudus

(3) K.V. Thimann (4) F. Skoog

2. Primary precursor or I.A.A. is–

(1) Phenyl alanine (2) Tyrosine

(3) Tryptophan (4) Leucine

3. The biological activity of I.A.A. is tested by–

(1) α - amylase test

(2) Avena curvature test

(3) Soybean callus test

(4) Xanthium leaf disc test

4. Indole, 3 acetic acid, called as auxin was first isolated from–

(1) Human urine (2) Corn germ oil

(3) Fusarium (4) Rhizopus

5. Which of the following effects of auxins is of wide application?

(1) Induction of fruit development

(2) Induction of root initiation

(3) Prevention of abscission

(4) All of the above

6. Stem elongation is affected by–

(1) Gibberellin and florigen

(2) Auxin and gibberellin

(3) Florigen and kinin

(4) Kinin and auxin

7. Apical dominance means–

(1) Suppression of growth of apical bud by axillary buds

(2) Suppression of growth of axillary buds by the presence of apical bud

(3) Stimulation of growth of axillary buds by removal of apical bud

(4) Inhibition of growth of axillary buds by removal of apical bud

8. Auxin inhibits the growth of–

(1) Apical bud

(2) Lateral axillary buds

(3) Roots on stem cutting

(4) Parthenocarpy development of fruits

9. Induction of rooting in stem cutting by auxin treatment would be beneficial in which of the following–

(1) Marchantia (2) Wheat

(3) Cuscuta (4)Bougainvillea

10. Which of the following is not a naturally occurring plant hormone?

(1) 2, 4-D (2) GA_2

(3) Gibberellin (4) I.A.A

11. Leaf fall occurs when the content of–

(1) Auxin increase

(2) Auxin decreases

(3) Abscisic acid decreases

(4) Gibberellic acid decreases

12. Substance which originates at the tip of stem to control growth–

(1) Vitamins (2) Enzymes

(3) Food materials (4) Auxins

13. Which of the growth substance acts as a stimulant during nodule formation in leguminous plant–
(1) Ethylene (2) ABA
(3) IAA (4) Morphactin

14. Auxanometer is meant for measuring–
(1) Respiratory activity
(2) Photosynthetic activity
(3) Growth activity
(4) Osmotic pressure

15. Apical dominance in higher plants is due to–
(1) Phytohormones (2) Enzymes
(3) Carbohydrates (4) Photoperiodism

16. Parthenocarpy is the production of–
(1) Fruits with pollination
(2) Fruits without fertilization
(3) Seeds with fertilization
(4) Only seeds and no fruits

17. Auxin is mainly produced by–
(1) Apical root meristem
(2) Root cambium
(3) Apical shoot meristem
(4) Phloem in shoot tip

18. In plants growth is–
(1) Restricted to certain regions or structure
(2) Irreversible
(3) Change in size
(4) All the above

19. Which one of the following forces helps in growth?
(1) Turgor pressure
(2) Root pressure
(3) Atmospheric pressure
(4) Osmotic pressure

20. Growth is primarily affected by two climatic factors which are?
(1) Light and temperature
(2) Temperature and relative humidity
(3) Light and wind
(4) Rainfall and temperature

21. In a growing plant, the first phase during the process of growth is–
(1) Cell division
(2) Cell enlargement
(3) Cell differentiation
(4) Cell maturation

22. The natural plant hormones were first isolated from–
(1) Cotton fruits, spinach leaves, and rice plant
(2) Avena coleoptiles, spinach leaves, and fungus Gibberella
(3) Human urine and corn germ oil
(4) Human urine and rice plant

23. Which one of the following nutrients is concerned with the growth of the plants in view or their role in the synthesis of auxin–
(1) S (2) Mn (3) Zn (4) K

24. Plants bend toward the light because–
(1) They need light for photosynthesis
(2) They need light for respiration
(3) Light attracts them
(4) Cells on the shaded side elongate more

25. Auxins are abundantly produced in–
(1) Root
(2) Meristematic region of root
(3) Shoot
(4) Meristematic region of the shoot

26. A plant shows flowering when exposed to 11 hours of photoperiod and flowering was not inhibited when dark period was interrupted by light. This plant must be a :

(1) LDP (2) SDP

(3) DNP (4) None of these

27. If the tip of seeding is cut off growth, as well as bending, ceases because it hampers–

(1) Respiration

(2) Photosynthesis

(3) Perception of light stimulus

(4) Transpiration

28. What causes a green plant to bend towards the light as it grows?

(1) Because green plants need light to carry on photosynthesis

(2) Because green plants are phototropic

(3) Light stimulates plant cells on the lighted side to grow faster

(4) Auxin accumulates on the shaded side

29. Growth hormone acts–

(1) Always as growth promotors

(2) Always are growth inhibitors

(3) Some as promotors and some as inhibitors

(4) Rarely as growth inducers

30. The movement of auxin is largely–

(1) Acropetal (2) Basipetal

(3) Lateral (4) Centripetal

31. Which growth hormone is responsible for apical dominance–

(1) Auxin (2) Cytokinin

(3) Gibberellin (4) Ethylene

32. 2, 4-D is a synthetic–

(1) Auxin (2) Gibberellin

(3) Cytokinin (4) Florigen

33. Which of the following induces femaleness in plants?

(1) Auxin & ethylene

(2) Ethanol

(3) ABA

(4) Gibberellin

34. Which of the following prevents the fall of leaves in the early stage?

(1) GA_3 (2) Auxin

(3) Ethylene (4) Zeatin

35. Which of the following is Dicot weed killer?

(1) 2, 4-D (2) NAA

(3) GA (4) ABA

36. Lateral axillary buds are not allowed to grow by–

(1) Auxin (2) Ethylene

(3) Gibberellin (4) Cytokinin

37. Richmond– Lang effect is due to

(1) Cytokinin (2) Auxin

(3) ABA (4) All the above

38. A hypothetical chemical believed to be involved in flowering is–

(1) Gibberellin (2) NAA

(3) Florigen (4) IAA

39. For most organisms growth curve is :

(1) S-shaped (2) Sigmoid

(3) L-Shaped (4) Both 1 & 2

40. Which of the following auxins are widely used as herbicides–
(1) 2, 4-D and 2, 4, 5-T
(2) 2, 4-D and cytokinin
(3) 2, 4-D and 2, 4-T
(4) 2, 4, 5-T and GA

41. The compounds that inhibit the action of auxin are known as–
(1) Antiauxins
(2) Auxins promotors
(3) Auxin precursors
(4) Both 1 & 2

42. Market period of fruits can be increased by :
(1) Auxin (2) GA_3
(3) ABA (4) None of these

43. Photoperiodic stimulus is picked up by–
(1) Phytochrome (2)Phytohormone
(3) Enzyme (4) Vernalin

44. Parthenocarpy can be achieved by–
(1) Zeatin (2) ABA
(3) Auxins (4) Kinetin

45. IAA was isolated by–
(1) Kogl and Erxleben
(2) Kogl and Haagen Smit
(3) Erxleben and Haagen Smit
(4) Kogl, Darwin and Haagen Smit

46. Maximum of growth occurs in–
(1) Exponential phase (2) Decline phase
(3) Stationary phase (4) Lag phase

47. Which of the following plant hormone substitutes for long photoperiod in flowering plant–
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Ethylene

48. Gibberellin stimulates flowering in–
(1) The plants growing in japanese farms
(2) The short day plants
(3) The long day plants
(4) Day neutral plants

49. Internodal elongation is stimulated by–
(1) Auxin (2) Cytokinin
(3) Gibberellin (4) Phenol

50. Cytokinin–
(1) Is a hormone whose main function is to induce the cell division
(2) Is the process of cell division
(3) Refers to cell division
(4) Causes dormancy

51. The excised leaf does not turn yellow if it is induced to root. The is attributed to synthesis in the root of–
(1) Ethylene (2) Cytokinins
(3) Gibberellins (4) Auxins

52. Hormone involved in photoperiodism is–
(1) IAA (2) Gibberellin
(3) Kinetin (4) 2, 4-D

53. Gibberellin was first extracted from–
(1) *Gibberella fujikuroi*
(2) *Gellidium*
(3) *Gracillaria*
(4) *Aspergillus*

54. Bolting hormone is–
(1) Auxin (2) Gibberellin
(3) ABA (4) Ethylene

55. The plant hormone, which synthesized in root and translocated to aerial parts is–
(1) Auxin (2) Cytokinin
(3) Traumatin (4) Morphactins

56. The elongation of genetically dwarf plants is brought about by the application of–

(1) Cytokinins (2) Gibberellins

(3) X-Rays (4) Vitamin-C

57. Gibberellin was isolated from–

(1) An alga (2) A fungus

(3) A bacterium (4) A virus

58. Gibberellins are–

(1) Growth inhibitors

(2) Growth promotor

(3) Not concerned with growth at all

(4) Of little potential in agriculture

59. Gibberellins do not cause–

(1) Shortening of genetically tall plants

(2) Stimulation of seed germination

(3) Promotion of parthenocarpy

(4) Induction of α-amylase synthesis in barley

60. Gibberellic acid has been successfully employed to induce flowering in–

(1) Short day plants under long day condition

(2) In long day plants under short day condition

(3) For some plants

(4) None of the above

61. The growth regulator that retards ageing of plant organ is-

(1) Auxin (2) Gibberellin

(3) Cytokinin (4) Abscisic acid

62. Which of the following hormones can replace vernalization ?

(1) Cytokinins (2) Auxins

(3) Ethylene (4) Gibberellin

63. Which of the following breaks the dormancy of seeds ?

(1) IAA (2) GA_3

(3) Ethylene (4) All the above

64. The firs cytokinin was discovered by-

(1) Skoog (2) Went

(3) Addicot (4) Miller

65. Richmond lang effect is-

(1) The effect of kinetins in delaying senescence

(2) The effect of auxin on root and shoot formation

(3) The effect of traumatic acid in wound formation

(4) None of these

66. Which of the following is a coconut milk factor ?

(1) Auxin (2) ABA

(3) Morphactin (4) Cytokinin

67. Which of the following induces morphogenesis in tissue culture?

(1) Gibberellin (2) Cytokinin

(3) IAA (4) Ethylene

68. The habit of Cabbage plant can be changed drastically by the application of -

(1) Auxin (2) Gibberellin

(3) Cytokinin (4) ABA

69. Richmond lang effect due to cytokinins pertains to

(1) Root formation

(2) Apical dominance

(3) Delay of senescence

(4) Leaf formation

70. The most common cytokinin is-

(1) IAA

(2) Kinetin

(3) Isopentanyl adenine

(4) Dehydrozeatin

71. Which one of the following is a gaseous plant hormone ?

(1) Auxin

(2) Gibberellin

(3) Ethylene

(4) Cytokinin

72. Pomalin is sprayed over apple to increase fruit size, it is-

(1) Auxin

(2) Mixture of auxin and gibberellin

(3) Mixture of auxin and cytokinin

(4) Mixture of cytokinin and gibberellin

73. Apical dominance can be overcome by application of-

(1) Auxin (2) Gibberellin

(3) Cytokinin (4) Florigen

74. In plants natural cytokinin was discovered by-

(1) Skoog & Miller

(2) Letham

(3) Benson & Calvin

(4) Thimann & went

75. The activity of α-amylase in the endospore of barley germinating seed is induced by-

(1) Ethylene (2) Cytokinin

(3) IAA (4) Gibberellin

76. Dormancy of seed is broken by-

(1) Auxin (2) Gibberellins

(3) Ethylene (4) Cytokinin

77. In tissue culture, differentiation of shoot is controlled by-

(1) Light Intensity

(2) Temperature shock

(3) Low Auxin + High CK

$\left(\text{High } \frac{\text{Cyto}}{\text{Auxin}} \text{Ratio}\right)$

(4) None

78. A natural growth regulator is-

(1) Ethylene (2) NAA

(3) 2, 4-D (4) Benzyladenine

79. Abscisic acid induces-

(1) Shoot elongation

(2) Cell elongation and cell wall formation

(3) Cell division

(4) leaf fall and dormancy

80. In autumn leaf fall occurs, because-

(1) Formation of abscission layer at the base

(2) Leaf becomes heavy

(3) Leaf does not remain green

(4) Of low temperature

81. Which of the following is growth inhibitor-

(1) IAA (2) ABA

(3) NAA (4) GA_3

82. During adverse environmental condition plants develop a stress hormone, which is ?

(1) Abscisic acid

(2) Ethylene

(3) Benzyl amino purine

(4) Dichlorophenoxy acetic acid

83. Abscisic acid treatment results in-

(1) Leaf expansion (2) Stem elongation

(3) Stomatal closure (4) Root elongation

84. Natural cell division inducing factor occurs in-

(1) Coconut milk

(2) Immature maize seeds

(3) Both

(4) Heated t - RNA

85. Fruits ripening hormone is-

(1) Kinetin (2) Gibberellin

(3) Ethylene (4) IAA

86. Morphactins are-

(1) Auxins

(2) Natural growth regulators

(3) Synthetic growth inhibitor

(4) Metabolic inhibitors

87. Which is a stress hormone?

(1) Benzyl aminopurine

(2) Dichlorophenoxy acetic acid

(3) Ethylene

(4) Abscisic acid

88. Seed dormancy is due to the-

(1) Ethylene (2) Abscisic acid

(3) IAA (4) Starch

89. Hormone responsible for senescence-

(1) ABA (2) Auxin

(3) GA (4) Cytokinin

90. Hormone responsible for vernalization-

(1) Florigen (2) Auxin

(3) Abscisin (4) Vernalin

91. Effect of day length on plant development is called

(1) Phototropism (2) Photoperiodism

(3) Chemotropism (4) Photosynthesis

92. Active form of phytochrome for seed Germination is-

(1) Pfr–form (2) Pr–form

(3) Both (4) None

93. Long day plants produces flowers when they are exposed to-

(1) Any duration of light

(2) Light period longer than a critical day length

(3) Light period longer than 12 hrs.

(4) None of these

94. Which of the following is a hypothetical hormone ?

(1) Gibberellin (2) Auxin

(3) Cytokinin (4) Florigen

95. Which plant is LDP ?

(1) Tobacco (2) Glycine max.

(3) Mirabilis (4) Spinach

96. Wheat, potato & henbane are-

(1) SDP (2) DNP (3) LNP (4) LDP

97. In short day plants (SDP) flowering is induced by

(1) Long night

(2) Photoperiod less than 12 hours

(3) Photoperiod shorter than critical value and uninterrupted long night.

(4) Short photoperiod and interrupted long night

98. Which one shows red far red interconversions ?

(1) Carotenoids (2) Cytochromes

(3) Chlorophyll (4) Phytochrome

99. Physiologically active form of phytochrome is-

(1) P_{730} (2) P_{660} (3) P_{700} (4) P_{680}

100. A long day plant is -

(1) *Xanthium* (2) *Chrysanthemum*

(3) Radish (4) Tomato

101. Which is not a plant hormone-

(1) Phytochrome (2) Florigen

(3) GA (4) IAA

102. A pigment concerned with both floral induction and seed germination is-

(1) Florigen (2) Chlorophyll

(3) Plastocyanin (4) Phytochrome

103. Which pigment absorbs the red and far-red ligh ?

(1) Cytochrome (2) Phytochrome

(3) Carotenoids (4) Chlorophyll

104. Plant hormone associated with Climacteric respiration is-

(1) Auxin (2) Cytokinin

(3) Ethylene (4) Gibberellin

105. Pruning of plants promotes branching, because the axillary buds get sensitized to-

(1) Ethylene (2) Gibberellin

(3) Cytokinin (4) IAA

106. Cell elongation in internodal regions of the green plants takes place due to-

(1) Ethylene (2) Indole acetic acid

(3) Cytokinin (4) Gibberellins

107. Gibberellins can promote seed germination because of their influence on:

(1) Rate of cell division

(2) Production of hydrolyzing enzymes

(3) Synthesis of abscisic acid

(4) Absorption of water through hard seed coat.

108. I.A.A. mainly inhibits growth of-

(1) Root

(2) Leaf

(3) Shoot

(4) Generally whole plant

109. How does pruning help in making the hedge dense

(1) The apical shoot grows faster after pruning

(2) It releases wound hormones

(3) It induces the differentiation of new shoots from the rootstock

(4) It frees axillary buds from apical dominance

110. Parthenocarpic tomato fruits can be produced by?

(1) Raising the plants from vernalized seeds

(2) Treating the plants with phenylmercuric acetate

(3) Removing androecium of flowers before pollen grains are released

(4) Treating the plants with low concentrations of gibberellic acid and auxins

111. Which one of the following pairs, is not correctly matched ?

(1) IAA - Cell wall elongation

(2) Abscisic acid - Stomatal closure

(3) Gibberellic acid - Leaf fall

(4) Cytokinin - Cell division

112. The wavelength of light absorbed Pr form of phytochrome is-

(1) 620 nm

(2) 640 nm

(3) 680 nm

(4) 720 nm

113. "Foolish seeding" disease of rice led to the discovery of -

(1) IAA (2) GA

(3) ABA (4) 2, 4-D

114. Senescence as an active developmental cellular process in the growth and functioning of a flowering plant, is indicated in-

(1) Annual plants

(2) Floral parts

(3) Vessels and tracheid differentiation

(4) Leaf abscission

115. Short days plants should be actually called–

(1) Long night plants

(2) Day neutral plants

(3) Photo neutral plants

(4) Light unaffected plants

116. Which is the critical period in short day plants ?

(1) Duration of light

(2) Duration of darkness

(3) Duration of both

(4) None of the above

117. Which pigment induces formation of florigen in short day plants ?

(1) P_r (2) P_{fr}

(3) Both of above (4) None of above

118. Which pigment induces synthesis of florigen in long day plants ?

(1) P_r

(2) P_{fr}

(3) Both of above

(4) None of the above

119. Which plant hormone is effective for inducing flowering in LDP under short day conditions ?

(1) Auxin

(2) Gibberellin

(3) Cytokinin

(4) None of the above

120. Phytochrome is related to –

(1) Seed germination in salad

(2) Inhibition of albinism and development of chloroplast

(3) Expansion of leaves in dicots

(4) All the above

121. Went found that curvature of coleoptile is –
(1) Directly proportional to concentration of auxin
(2) Inversely proportional to concentration of auxin
(3) Not affected by concentration of auxin
(4) None of the above

122. In which plant Went discovered auxin ?
(1) *Phalaris canarienses*
(2) *Avena sativa*
(3) *Mirabilis jalapa*
(4) *Oryza sativa*

123. How does the polar transport of auxins occurs ?
(1) From tip towards base
(2) From base towards tip
(3) From centre towards lateral side
(4) From lateral side towards centre

124. Parthenocarpy can be induced by –
(1) IAA (2) NAA
(3) IBA (4) All the above

125. Testing of biologically active substances on living beings is called –
(1) Biological testing (2) Utility testing
(3) Bio-assay (4) Active assay

126. What is the reason of bakane disease of rice ?
(1) Bacteria (2) Mycoplasma
(3) Fungus (4) Virus

127. Gibberellins are found in –
(1) Algae, fungi and bacteria
(2) Bryophytes, pteridophytes and gymnosperms
(3) Angiosperms
(4) All the above

128. Gibberellin is synthesized in –
(1) Rhizome & root tip
(2) Young developed leaves
(3) Young expanded leaf
(4) All the above

129. Which of these effect is due to gibberellins ?
(1) Internode elongation
(2) Bolting
(3) Breaking of dormancy
(4) All the above

130. Due to the effect of which substance flowering can be induced even in the absence of vernalisation ?
(1) Gibberellin (2) Auxin
(3) Cytokinin (4) Ethylene

131. What is the chemical name of Kinetin ?
(1) 6-(4 hydroxy 3-methyl trans 2-butene aminopurinol)
(2) 6-furfuryl aminopurine
(3) Dimethyl allyl adenine
(4) None of the above

132. Delay of senescence is called –
(1) Richmond effect
(2) Lang effect
(3) Richmond–Lang effect
(4) None of the above

133. What happens during delay of senescence ?
(1) Chlorophyll breakdown stops in the treated area
(2) Transfer of proteins, amino acids and auxins towards the treated area
(3) More protein synthesis in the treated area
(4) All the above

134. Which is called the fruit ripening hormone ?

(1) Auxin (2) Gibberellin

(3) Ethylene (4) All the above

135. Ethylene synthesis occur in –

(1) Fruit (2) Stem

(3) Leaf (4) All the above

136. Which are the climacteric fruits ?

(1) Fruits forming auxins in more quantity during fruit ripening

(2) Fruits forming ethylene in more quantity during fruit ripening

(3) Fruits forming gibberellin in more quantity during fruit ripening

(4) Fruits forming cytokinin in more quantity during fruit ripening

137. The increase in rate of respiration during ripening of fruits is called –

(1) Fruit ripening respiration

(2) Climacteric respiration

(3) Maturation respiration

(4) Climax respiration

138. Chemically abscisic acid is –

(1) Terpenoid

(2) Fatty acid

(3) Precursor of typical fat

(4) Steroid

139. Abscission in leaves occurs due to –

(1) Abscisic acid

(2) Ethylene

(3) Combined effect of both

(4) None of the above

140. Which effect is due to abscisic acid ?

(1) Induction of dormancy in buds and seeds

(2) Inhibition of growth

(3) Senescence

(4) All the above

141. How is distribution of auxin affected by light ?

(1) Less toward dark, more towards light

(2) Less toward light, more towards dark

(3) More toward light, zero towards dark

(4) None of the above

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	1	3	2	1	4	2	2	2	4	1	2	4	3	3	1	2	3	4	1	1	1	3	3	4	4
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Ans.	1	3	4	3	2	1	1	1	2	1	1	1	3	4	1	1	2	1	3	2	1	2	3	3	1
Que.	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	2	2	1	2	2	2	2	2	1	2	3	4	2	4	1	4	2	2	3	3	3	4	3	2	4
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	2	3	1	4	1	2	1	3	3	3	3	4	2	1	4	2	1	2	4	4	4	3	4	1	3
Que.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Ans.	1	4	2	3	3	4	2	1	4	4	3	2	2	4	1	2	1	2	2	4	1	2	1	4	3
Que.	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141									
Ans.	3	4	4	4	1	2	3	4	3	4	2	2	1	3	4	2									

Exercise - II

1. Plant hormones are : -
(1) Growth regulators
(2) Growth promoters
(3) Growth inhibitors
(4) None of above

2. The most common auxin is : -
(1) GA (2) ABA
(3) Kinetin (4) IAA

3. Gibberellin promotes cell division and elongation in :
(1) Leaves (2) Roots
(3) Shoots (4) All of these

4. Which of the following is used for ripening of fruits
(1) Auxin (2) ABA
(3) Ethylene gas (4) Cytokinin

5. Induction of flowering is plants by low-temperature treatment is called :
(1) Vernalization (2) Photoperiodism
(3) Cryobiology (4) Chilozology

6. Hormore produced during leaf fall is :
(1) IAA (2) ABA
(3) Florigen (4) Kinetin

7. Climacteric fruit shows :
(1) High respiration rate at ripening
(2) Sudden change in taste
(3) Sudden change in colour and shape
(4) None of the above

8. Phytochrome is present in :
(1) Vascular cryptogams
(2) Prokaryotes
(3) Brain cell
(4) Kidney cell

9. Genetically dwarf plant can be converted into a plant of normal height with the application of :
(1) Auxin (2) Gibberellin
(3) Cytokinins (4) Auxin

10. Phytochrome is responsible for :
(1) Photosynthesis (2) Flowering
(3) Fruit formation (4) Respiration

11. Which of the following is a gaseous hormone ?
(1) Ethylene
(2) Cytokinin
(3) Both ethylene and auxin
(4) Gibberellin

12. The pineapple which under natural conditions is difficult to blossom has been made to produce fruits throughout the year by the application of :
(1) IAA, IBA
(2) NAA, 2,4-D
(3) Phenyl murcuric acid
(4) Cytokinins

13. In what respect auxin and cytokinins act antagonistic ?
(1) Cell divsion
(2) Plant growth
(3) Growth of lateral buds
(4) Delay in senescence

14. Certain chemical substances having profound effect on plant growth are called :
(1) Catalyic agents (2) Phytohormones
(3) Enzymes (4) Compost

15. A pigment concerned with floral induction is

(1) Florigen (2) Chlorophyll

(3) Plastocyanin (4) Phytochrome

16. The presence of auxins in a solution could be tested

(1) Avena sativa stem tip test

(2) Carbon tetrachloride test

(3) Iodine test

(4) Defoliation test

17. Auxanometer is used to measure :

(1) Length (2) Width

(3) Depth (4) Growth

18. The pigment sensitive for red and far red light is

(1) Chlorophyll (2) Phytochrome

(3) Cytochrome (4) Carotene

19. Hormone which breaks seed dormancy is :

(1) Auxin (2) Gibberellin

(3) Ethylene (4) Cytokinin

20. Which one of the following is not a synthetic auxin

(1) 2, 4-D (2) 2-4-5-T

(3) NAA (4) IAA

21. Which plant hormone causes fruit ripening:

(1) IAA (2) Cytokinin

(3) Ethylene (4) GA

22. Which hormone is responsible for apical growth

(1) IAA (2) ABA

(3) GA (4) All of these

23. Abscisic acid promotes:

(1) Cell elongation and cell wall formation

(2) Shoot elongation

(3) Leaf fall and dormancy

(4) Cell division

24. Which hormone is used to induce ripening in banana

(1) Cytokinin (2) Ethylene

(3) ABA (4) GA_3

25. Which among the following is a synthesis plant hormone :

(1) IAA (2) GA

(3) 2, 4-D (4) ABA

26. Richmond-Lang effect is shown by :

(1) Auxins (2) Sugars

(3) Zeatin (4) Gibberellins

27. Ethylene gas is used for :

(1) Growth of plants

(2) Delaying fruit's abscission

(3) Ripening of fruits

(4) Stopping the leaf abscission

28. Which of the following plant hormone is extracted from fungus :

(1) Ethylene (2) Gibberellin

(3) Cytokinin (4) 2, 4 D

29. Highest concentration of auxin is found in :

(1) Shoot tips

(2) Cork

(3) Mid stem portion

(4) Companian cells

30. Day neutral plant is :

(1) Cotton (2) Tobacco

(3) Sugarcane (4) Henbane

31. Phytotron is :

(1) A controlled condition chamber for plants

(2) Leaf culture process

(3) Special culture of seeds

(4) Root culture process

32. Phytochrome occurs in two forms. It's stable form is :

(1) P_{fr} forms (2) P_r forms

(3) Both forms (4) None of these

33. Which pigment is responsible for flowering in plant

(1) Phytochrome

(2) Cytochrome

(3) Anthocyanin

(4) xanthophyll

34. Which of the following plant is LDP

(1) Xanthium (2) Soyabean

(3) Wheat (4) Tobacco

35. Phototropism is due to the hormone

(1) IAA (2) GA

(3) 2-4 D (4) Cytokinin

36. Photoperiodism affects :

(1) Vegetative growth

(2) Internode elongation

(3) Seed germination

(4) Reproductive growth

37. The activity of α-amylase in the endosperm of barley germinating seed is induced by :

(1) Ethylene (2) Cytokinin

(3) I.A.A. (4) Gibberellin

38. For which of the following vernalisation of seeds is necessary for inducing early flowering or in first flowering season itself :

(1) Spring variety of wheat

(2) Cabbage

(3) Mustard

(4) Tomato

39. Phytohormone commonly called stress hormone is

(1) Auxin (2) Abscissic acid

(3) Gibberellin (4) Cytokinins

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	1	4	4	3	1	2	1	1	2	2	1	1	3	2	4	1	4	2	2	4	3	1	3	2	3
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39											
Ans.	3	3	2	1	1	1	2	1	3	1	4	4	2	2											

Exercise – III (Previous Year Questions)

[AIPMT-2009]

1. One of the synthetic auxin is -

(1) IBA (2) NAA

(3) IAA (4) GA

2. Which one of the following acids is a derivative of carotenoids?

(1) Abscisic acid

(2) Indole butyric acid

(3) Indole-3-acetic acid

(4) Gibberellic acid

[AIPMT-2010 (Pre)]

3. Phototropic curvature is the result of uneven distribution of-

(1) Cytokinins (2) Auxin

(3) Gibberellin (4) Phytochrome

4. Photoperiodism was first characterised in-

(1) Tomato (2) Cotton

(3) Tobacco (4) Potato

5. Coiling of garden pea tendrils around any support is an example of-

(1) Thigmotropism (2) Thermotaxis

(3) Thigmotaxis (4) Thigmonasty

[AIPMT-2010 (Mains)]

6. One of the commonly used plant growth hormone in tea plantations is-

(1) Absicisic acid

(2) Zeatin

(3) Indole-3-acetic acid

(4) Ethylene

7. Root development is promoted by :

(1) Auxin (2) Gibberellin

(3) Ethylene (4) Absicisic acid

[RPMT-2011]

8. One of the commonly used plant growth hormone in tea plantations is -

(1) ABA (2) Zeatin

(3) IAA (4) Ethylene

[AIPMT-Mains 2012]

9. Which one of the following generally acts as an antagonist to gibberellins ?

(1) ABA (2) IAA

(3) Zeatin (4) Ethylene

10. Vernalisation stimulates flowering in :

(1) Carrot (2) Ginger

(3) Zamikand (4) Turnmeric

11. Through their effect on plant growth regulators, what do the temperature and light control in the plants ?

(1) Closure of stomata

(2) Fruit elongation

(3) Apical dominance

(4) Flowering

[AIPMT 2014]

12. Dr. F. Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly-cut coleoptile stumps. Of what significance is this experiment ?

(1) It made possible the isolation and exact identification on auxin.

(2) It is the basis for quantitative determination of small amounts of growth-promotting substances.

(3) It supports the hypothesis that IAA is auxin.

(4) It demonstrated polar movement of auxins.

13. A few normal seedling of tomato were kept in a dark room. After a few days they were found to have become white-coloured like albino. Which of the following terms will you use to describe them ?

(1) Mutated (2) Embolised

(3) Etiolated (4) Defoliated

14. Which one of the following growth regulators is known as stress hormone ?

(1) Abscissic acid

(2) Ethylene

(3) GA_3

(4) Indole acetic acid

[AIPMT 2015]

15. Typical growth curve in plants is :

(1) Linear

(2) Stair-steps shaped

(3) Parabolic

(4) Sigmoid

16. What causes a green plant exposed to the light on only on side, to bend toward the source of light as it grows ?

(1) Green plants seek light because they are phototropic

(2) Light stimulates plant cells on the lighted side to grow faster

(3) Auxin accumulates on the shaded side, stimulating greating cell elongatio there

(4) Green plants need light to perform photosynthesis

[Re-AIPMT 2015]

17. Auxin can be bioassayed by :

(1) Lettuce hypocotyle elongation

(2) Avena coleoptile curvature

(3) Hydroponics

(4) Potometer

[NEET-I 2016]

18. The avena curvature is used for bioassay of

(1) ABA (2) GA

(3) IAA (4) ethylene

[NEET-II 2016]

19. You are given a tissue with its potential for differentiation in an artificial culture. Which of the following pairs of hormones would you add to the medium to secure shoots as well as roots ?

(1) Auxin and cytokinin

(2) Auxin and abscisis acid

(3) Gibberellin and abscisic acid

(4) IAA and gibberellin

20. Phytochrome is a :

(1) glycoprotein (2) lipoprotein

(3) chromoprotein (4) flavoprotein

[NEET 2017]

21. Fruit and leaf drop at early stages can be prevented by the application of :

(1) Cytokinins (2) Ethylene

(3) Auxins (4) Gibberillic acid

[NEET 2019]

22. What is the site of perception of photoperiod necessary for induction of flowering in plants ?

(1) Shoot apex (2) Leaves

(3) Lateral buds (4) Pulvinus

23. It takes long time for pineapple plants to produce flowers. Which combination of hormones can be applied to artificially induce flowering in pineapple plants throughout the year to increase yield ?

(1) Gibberellin and Abscisic acid

(2) Cytokinin and Abscisic acid

(3) Auxin and Ethylene

(4) Gibberellin and Cytokinin

[NEET(UG) 2019 (Odisha)]

24. Removal of shoot tips is a very useful technique to boost the production of tea-leaves. This is because:

(1) Gibberellins prevent bolting and are inactivated

(2) Auxins prevent leaf drop at early stages

(3) Effect of auxins is removed and growth of lateral buds is enhanced.

(4) Gibberellins delay senescence of leaves.

25. In order to increase the yield of sugarcane crop, which of the following plant growth regulators should be sprayed?

(1) Ethylene (2) Auxins

(3) Gibberellins (4) Cytokinins

[NEET 2020]

26. The process of growth is maximum during :

(1) Dormancy (2) Log phase

(3) Lag phase (4) Senescence

27. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.

(1) Abscisic acid (2) Cytokinin

(3) Gibberellin (4) Ethylene

28. Which of the following is not an inhibitory substance governing seed dormancy?

(1) Para-ascorbic acid

(2) Gibberellic acid

(3) Abscisic acid

(4) Phenolic acid

[NEET 2020 (COVID-19)]

29. Who coined the term 'Kinetin' ?

(1) Skoog and Miller (2) Darwin

(3) Went (4) Kurosawa

30. Inhibitory substances in dormant seeds cannot be removed by subjecting seeds to:

(1) Gibberellic acid

(2) Nitrate

(3) Ascorbic acid

(4) Chilling conditions

31. Match the following concerning the activity/function and the phytohormone involved:

(a) Fruit ripener (i) Abscisic acid

(b) Herbicide (ii) GA_3

(c) Bolting agent (iii) 2, 4-D

(d) Stree hormone (iv) Ethephon

Select the correct option from following :

(1) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

(2) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

(3) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

(4) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

[NEET-2021]

32. Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called :

(1) Elasticity (2) Plasticity

(3) Flexibility (4) Maturity

33. The site of perception of light in plants during photoperiodism is :

(1) Shoot apex (2) Axillary bud

(3) Stem (4) Leaf

34. The plant hormone used to destroy weeds in a field is :

(1) IAA (2) NAA

(3) 2,4-D (4) IBA

[NEET-2022]

35. Production of Cucumber has increased manifold in recent years. Application of which of the following phytohormones has resulted in this increased yield as the hormone is known to produce female flowers in the plants:

(1) ABA (2) Gibberellin

(3) Ethylene (4) Cytokinin

36. The gaseous plant growth regulator is used in plants to:

(1) speed up the malting process

(2) promote root growth and roothair formation to increase the absorption surface

(3) help overcome apical dominance

(4) kill dicotyledonous weeds in the fields

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	2	1	2	3	1	2	1	2	1	1	4	2	3	1	4	3	2	3	1	3	3	2	3	3	3
Que.	26	27	28	29	30	31	32	33	34	35	36														
Ans.	2	3	2	1	3	3	3	4	3	3	2														