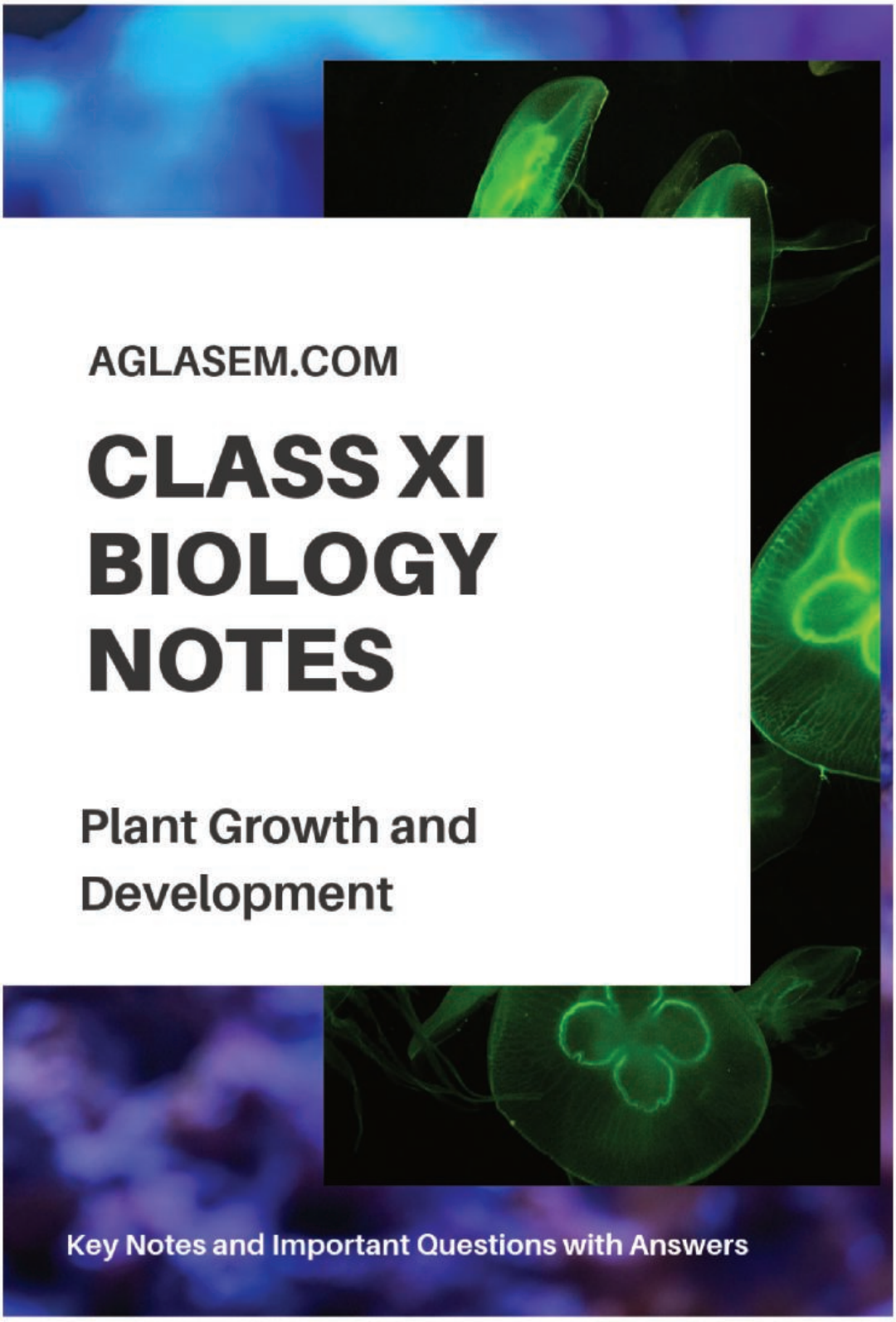
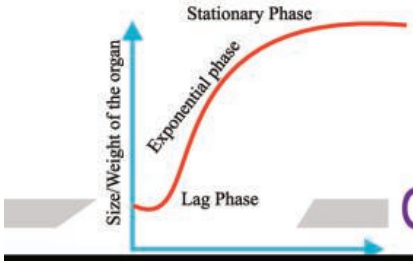


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CLASS XI BIOLOGY NOTES

Plant Growth and Development

Key Notes and Important Questions with Answers



Chapter - 15

Plant Growth and Development

Points To Remember

Seed Germination : The seed germinates only when favourable conditions for growth exists in the environment. In absence of favourable conditions it goes into a period of suspended growth or rest, called dormancy.

Abscission : Shedding of plant organs like leaves, flowers and fruits etc. from the mature plant.

Apical dominance : Suppression of the growth of lateral buds in presence of apical bud.

Dormancy : A period of suspended activity and growth usually associated with low metabolic rate. Some, seeds undergo a period of dormancy and can germinate only after dormancy period gets over.

Phytochrome : A pigment, found in plants which control the light dependent developmental process.

Phytohormone : Chemicals' secreted by plants in minute quantities which influence the physiological activities.

Sensecene : The last phase of growth when metabolic activities decrease.

Vernalisation : A method of promoting flowering by exposing the young plant to low temperature.

Growth : An irreversible permanent increase in size, volume and weight of an organ or its parts or even of an individual.

Quiescence : Non germination of a viable seed due to non-availability of proper environmental conditions.

Vivipary : It is the germination of seed while it is still attached to the parent plant and is nourished by it. *e.g., Rhizophora* and *Sonneratia*. As the germinating seed forms a seedling. It all down into the mud due to increase in weights. In the mud, lateral roots develops for anchorage.

Heterophylly : Occurrence of more than one type of leaves in plants *e.g.,* larkspur, Coriander leaves of Juvenile plant are different in shape from mature plant.

Bolting : Elongation of internodes prior to flowering in plants like Cabbage.

Photoperiodism : Response of Plants to relative periods of day/night to induce flowering.

According to duration of exposure of plants to light, plants are divided in 3 categories :

1. **Long Day Plants (LDP)**—Plants which need exposure to light for period exceeding critical duration *e.g.,* wheat, rice, cucumber.
2. **Short Day Plants (SDP)**—Plants that need exposure to light for period less than the critical length *e.g.,* Cabbage.
3. **Day Neutral Plants (DNP)**—There is no correlation between exposure to light duration & induction of flowering *e.g.,* Tomato.

Abbreviations

IAA	Indole acetic acid
NAA	Napththalene acetic acid
ABA	Abscisic acid
IBA	Indole-3 butyric acid
2.4D	2.4 dichlorophenoxy acetic acid
PGR	Plant growth regulator

Seed Dormancy	Quiescence
It is the condition of seed when it is unable to germinate in spite of the availability of all environmental conditions suitable for germination.	The condition of a seed when it is unable to germinate because the conditions for germination are not available.

Measurement of growth : Plant growth can be measured by a variety of ft parameters like increase in fresh weight, dry weight, length, area, volume and cell number.

Phases of growth : The period of growth is generally divided into three phases, namely, meristematic, elongation and maturation.

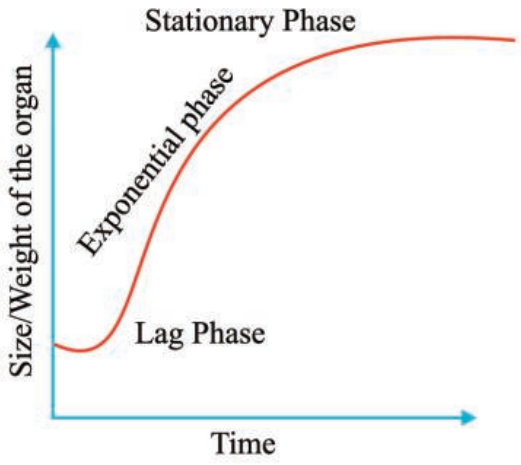
(i) Meristematic zone : New cell produced by mitotic division at root-tip and shoot-tip thereby show increase in size. Cells are rich in protoplasm and nuclei.

(ii) Elongation zone : Zone of elongation lies just behind the meristematic zone and concerned with enlargement of cells.

(iii) Maturation zone : The portion lies proximal to the phase of elongation. The cells of this zone attain their maximum size in terms of wall thickning and protoplasmic modification.

Growth rate : The increased growth per unit time is termed as growth rate. The growth rate shows an increase that may be arithmetic or geometrical.

Growth	Mathematical expression	Curve
In Arithmetic growth : Only one daughter cell continues to divide mitotically while other differentiate and matures.	$L_1 = L_0 + rt$ L_1 = Length at time t L_0 = Length at time zero r = growth rate	Linear curve



Sigmoid Growth Curve

Geometrical growth	Formula	Shape of curve
The initial growth is slow (lag phase) and increase rapidly there-after at an exponential rate (log phase) In both, the progeny cells divide mitotically and continue to do so. However, with limited nutrient supply, the growth slow down leading to stationary phase.	$W_1 = W_0 e^{rt}$ W_0 = Initial size W_1 = Final Size r = growth rate t = time of growth e = base of natural logarithms	Sigmoid or S-curve

Sigmoid growth curve

Lag phase—Growth is slow in initial stage.

Log phase : Period of maximum growth

Stationary phase—When the nutrients become limiting, growth slows down.

Relative Growth : The growth per unit time as percentage of initial size

$$\text{RGR} = \frac{\text{Growth per unit time}}{\text{Initial size}} \times 100$$

Differentiation : A biochemical or morphological change in meristemic cell (at root apex and shoot apex) to differentiate into permanent cell is called differentiation.

Dedifferentiation : The phenomenon of regeneration of permanent tissue to become meristematic is called dedifferentiation.

Redifferentiation : Meristems/tissue are able to produces new cells that once again lose the capacity to divide but nature to perform specific functions.

Conditions or factors influencing Growth

1. Nutrition 2. Availability of water 3. Temperature 4. Oxygen 5. Light 6. Gravity 7. Stress factors like minerals, water or temperature etc.

Phytohormone or Plant Growth-Regulator

Growth promoting hormones : These are involved in growth promoting activities such as cell division, cell enlargement, flowering, fruiting and seed formation. *e.g.,* Auxin, gibberellins, cytokinis.

Growth inhibitor : Involved in growth inhibiting activities such as dormancy and abscission. *e.g.,* Abscisic acid and Ethylene.

Hormones	Functions
1. Auxins (Growth Promoters) e.g.Indole 3-Acetic Acid [2, 4-D and 2, 4, 5,-T etc.]	1. Apical dominance, cell elongation, Promote flowering prevent premature leaf and fruit falling, initiate rooting in stem cutting, as weedicide, induce parthenocarpy.
2. Gibberellins (Growth Promoters) eg. [$GA_3 (C_{19}H_{22}O_6$ GA_4, GA_7, GA_{19} and GA_{20} etc.]	2. Delay senescence, speed up malting process, increase in length of axis (grape stalk), increase in length of stem (sugarcane), bolting in beet, cabbages and many plants with rosette habit.

3. Cytokinins (Growth Promoters) *e.g.* [Zeatin (trans 6-purine DMAA-Dimethylalyl adenine and Isopentyl adenine (IP) etc.]	3. Promote cell division, induce cell enlargement, reduce apical dominance, induce growth in auxiliary bud, chlorophyll preservation, lateral shoot growth, adventitious root formation.
4. [Ethylene ($H_2C = CH$) A goreous PGR which acts as Growth Promoters as well growth inhibitor (mainly as growth inhibitor)	4. Promotes senescence and abscission of leaf and fruits, promotes ripening of fruits, break seed and bud domancy, initiate germination in peanut, sprouting of potato tuber, promotes root growth and root hair formation.
5. Abscisic acid (ABA) eg. (Abscisin II Dormin)	5. Inhibit seed germination, stimulate closer of stomata, increase tolerance to various stress, induce dormancy in seed and bud, promotes ageing of leaf (senescence). Can delay the ripening of stored fruits as it absorbs the ethylene.

Questions

Very Short Answer Question (1 mark each)

1. Write the cause of 'Bakane' disease of rice.
2. Name the plant hormone which was first isolated from human urine.
3. Name the only gaseous plant hormone.
4. How does abscisic acid acts as stress hormone in drought condition ?
5. A farmer observed some broad-leaved weeds in a wheat crop farm. Which plant hormone would you suggest remove them ?
6. Name the plant growth regulators you should use to (a) Increase the yield of sugarcane (b) Promote lateral growth (c) Cause sprouting of potato tuber (d) Inhibit seed germination.
7. Why do lateral buds start developing into branches when apical bud is removed ?
8. Flowering in certain plant occur only when they are exposed to low temperature for a few weeks. Name this phenomenon.

9. Name, the hormone released from over-ripe apples and affects all other apples in a small wooden box.

Short Answer Question-I (2 marks each)

10. How will you induce lateral branching in a plant which normally does not produce them ? Give reason.
11. What induces ethylene formation in plants ? Give any two different action of ethylene on plants.
12. What is meant by abscission ? Name phytohormone involved in it.
13. What is meant by apical dominance ? Which hormone control it ?
14. Differentiate between photoperiodism and vernalization.
15. Name a hormone which is :

    (a) gaseous in nature (b) responsible for photo tropism (c) used for killing dicot weeds (d) Induces flowering in long day plants.

Short Answer Questions-II (3 marks each)

16. A primary root grows from 5 cm to 19 cm in a week. Calculate the growth rate and relative growth over the period.
17. Where are the following hormones synthesised in plants (a) IAA (b) Gibberellins (c) cytokinins.
18. What would be expected to happen if :
    (a) GA_3 is applied to rice seedling.
    (b) a rotten fruit get mixed with unripe fruits.
    (c) you forget to add cytokinin to the culture medium.
19. Which growth hormone is responsible for the following :
    (a) induce rooting in a twig
    (b) quick ripening of a fruit
    (c) delay leaf senescence
    (d) 'bolt' a rosette plant
    (e) induce immediate stomatal closure in leaves (f) Induce growth in axillary buds.
20. Define differentiation, dedifferentiation and redifferentiation.
21. Where are auxins generally produced in a plant ? Name any one naturally occurring plant auxin and any one synthetic auxin.

22. Define growth rate. Name two types of growth. Give the shape of curve for these growth.
23. Mention various parameters taken into consideration for measuring the growth.

Long Answer Question (5 marks each)

24. In list the five categories of phytohormone. Write atleast two uses of each.

Answers

Very Short Answer (1 mark each)

1. *Gibberalla fujkuroi.*
2. Auxin
3. Ethylene
4. ABA cause rapid closure of stomata, preventing loss of water by transpiration.
5. 2.4-D
6. (a) Gibberellin (b) Cytokinin
   (c) Ethylene (d) Abscisic acid
7. Due to inhibit activity of Auxin lateral growth starts.
8. Vernalisation
9. Ethylene

Short Answers-I (2 marks each)

10. When apical bud is removed, lateral branches are produced. Removal of apical bud effect the auxin is destroyed inducing the lateral buds to grow rapidly.
11. Refer NCERT Book Page no. 250.
12. - Premature fall of leaf and fruit is called abscission.
    - Abscisic acid
13. Refer NCERT Boof Page no. 250.
14. Refer NCERT Boof Page no. 252.
15. (a) Ethylene C_2H_2 (b) Auxin (c) 2, 4-D (d) Gibberellin

Short Answers-II (3 marks each)

16. (a) Growth = 19 – 5 = 14 cm, Period = 7 days

$$\text{Growth rate} = \frac{14}{7} = 2\text{cm/day}$$

(b) Inititial growth = $\frac{7}{5}$ cm

Growth rate per day $\frac{19-5}{7} = 2$ cm

Relative growth rate = $\frac{2}{5} \times 100 = 40\%$

17. (a) 1AA = Shoot apex
    (b) Gibberellin – young leaves of buds, root tips
    (c) Cytokinins – Root apical meristan
18. (a) Hyper elongation of intenodes of rice seedlings will occur.
    (b) Unripe fruit s will lead to early ripening and ultimately it will result in rottening.
    (c) Short but formation will not occur.
19. Refer NCERT Book.
20. Refer NCERT Text Book Page no. 245.
21. Refer NCERT Text Book Page no. 248.
22. Refer NCERT Text Book Page no. 242 and 243.
23. Refer NCERT Text Book Page no. 241.

Long Answers (5 marks each)

24. Refer NCERT Text Book Page no. 241-250.