

# Chapter 15 (PLANT GROWTH AND DEVELOPMENT)

## Multiple Choice Questions

Q1. Ethylene is used for

- (a) Retarding ripening of tomatoes
- (b) Hastening of ripening of fruits
- (c) Slowing down ripening of apples
- (d) Both (b) and (c)

Ans: (b) Ethylene is used for hastening of ripening of fruits.

Q2. Coconut water contains

- (a) ABA
- (b) auxin
- (c) cytokinin
- (d) gibberellin

Ans: (c) Coconut water contains cytokinin.

Q3. The effect of apical dominance can be overcome by which of the following hormone?

- (a) IAA
- (b) Ethylene
- (c) Gibberellin
- (d) Cytokinin

Ans: (d) The effect of apical dominance can be overcome by cytokinin hormone.

Q4. Match the following:

A.	IAA	(0	Herring sperm DNA
B.	ABA	(ii)	Bolting
C.	Ethylene	(iii)	Stomatal closure
D.	GA	(iv)	Weed-free lawns
E.	Cytokinins	(v)	Ripening of fruits

**Ans:** (a)

A.	IAA	(iv)	Weed-free lawns
B.	ABA	(iii)	Stomatal closure
C.	Ethylene	(v)	Ripening of fruits
D.	GA	(ii)	Bolting
E.	Cytokinins	(i)	Herring sperm DNA

**Q5. Apples are generally wrapped in waxed paper to**

- (a) prevent sunlight for changing its colour**
- (b) prevent aerobic respiration by checking the entry of O<sub>2</sub>**
- (c) prevent ethylene formation due to injury**
- (d) make the apples look attractive**

**Ans:** (b) Apples are generally wrapped in waxed paper to prevent aerobic respiration by checking the entry of O<sub>2</sub>.

**Q6. Growth can be measured in various ways. Which of these can be used as parameters to measure growth?**

- (a) Increase in cell number**
- (b) Increase in cell size**
- (c) Increase in length and weight**
- (d) All the above**

**Ans:** (d) Growth can be measured in various ways. Increase in cell number, increase in cell size and increase in length and weight are used as parameters to measure growth.

**Q7. The term synergistic action of hormones refers to**

- (a) when two hormones act together but bring about opposite effects**
- (b) when two hormones act together and contribute to the same function**
- (c) when one hormone affects more than one function**
- (d) when many hormones bring about any one function**

**Ans:** (b) The term synergistic action of hormones refers to when two hormones act together and contribute to the same function.

**Q8. Plasticity in plant growth means that**

- (a) plant roots are extensible**

- (b) plant development is dependent on the environment
- (c) stems can extend
- (d) none of the above

**Ans:** (b) Plasticity in plant growth means that plant development is dependent on the environment.

**Q9. To increase sugar production in sugarcanes, they are sprayed with**

- (a) IAA
- (b) cytokinin
- (c) gibberellin
- (d) ethylene

**Ans:** (c) To increase sugar production in sugarcanes, they are sprayed with gibberellin.

**Q10. ABA acts antagonistic to**

- (a) ethylene
- (b) cytokinin
- (c) gibberellic acid
- (d) IAA

**Ans:** (c) ABA acts antagonistic to gibberellic acid.

**Q11. Monocarpic plants are those which**

- (a) bear flowers with one ovary
- (b) flower once and die
- (c) bear only one flower
- (d) all of the above

**Ans:** (b) Monocarpic plants are flower once and die.

**Q12. The photoperiod in plants is perceived at**

- (a) meristem
- (b) flower
- (c) floral buds
- (d) leaves

**Ans:** (d) The photoperiod in plants is perceived at leaves.

**Very Short Answer type Questions**

**Q1. Fill in the places with appropriate word/words.**

- a. A phase of growth which is maximum and fastest is .
- b. Apical dominance as expressed in dicotyledonous plants is due to the presence of more \_\_\_\_ in the apical bud than in the lateral ones.
- c. In addition to auxin, a \_\_\_\_\_ must be supplied to culture medium to obtain a good callus in plant tissue culture.
- d. \_\_\_\_\_of a vegetative plants are the sites of photoperiodic perception.

**Ans:** a. Exponential/log phase of an S-curve.

b. Auxin/IAA

c. Cytokinin/Kinetin/6 BAP/Zeatin/etc.

d. Leaves

**Q2. Plant growth substances (PGS) have innumerable practical applications. Name the PGS you should use to**

- a. increase yield of sugar cane
- b. promote lateral shoot growth
- c. cause sprouting of potato tuber
- d. inhibit seed germination

**Ans:** a. GA<sub>3</sub>/gibberellin/gibberellic acid

b. Cytokinin/zeatin/kinetin/6 BAP/Zeatin/etc.

c. C<sub>2</sub>H<sub>4</sub>/Ethylene

d. ABA/Abcisic acid

**Q3. A primary root grows from 5 cm to 19 cm in a week. Calculate the growth rate and relative growth rate over the period.**

**Ans. Growth rate**

$$L_t = L_0 + rt$$
$$\Rightarrow 19 - 5 = r \times 1$$

14 cm per week

$$\text{Relative growth rate} = \frac{\text{Change}}{\text{Initial}} \times 100$$
$$= \frac{19 - 5}{5} \times 100$$
$$= \frac{14}{5} \times 100 = 280\%$$

**Q4. Gibberellins were first discovered in Japan when rice plants were suffering from bakane (the foolish seedling disease) caused by a fungus Gibberella fujikuroi.**

**a. Give two functions of this** priytohormone.

**b. Which property of Gibberellin caused foolish seedling disease in rice?**

**Ans:** a. GA3 is used to speed up the malting process in brewing industry. Gibberellins also promote bolting (internode elongation just prior to flowering) in beet, cabbages and many plants with rosette habit.

b. Gibberellin causes foolish seedling disease in rice because it has the property of internode elongation.

**Q5. Gibberellins promote the formation of \_\_\_\_\_ flowers on genetically \_\_\_\_\_ plants in Cannabis whereas ethylene promotes formation of \_\_\_\_\_ flowers on genetically \_\_\_\_\_ plants.**

**Ans:** Gibberellins promote the formation of male flowers on genetically female plants in Cannabis whereas ethylene promotes formation of female flowers on genetically male plants.

**Q6. Classify the following plants into Long-Day Plants (LDP), Short-Day Plants (SDP) and Day-Neutral Plants (DNP) Xanthium, Henbane (Hyoscyamus niger), Spinach, Rice, Strawberry, Bryophyllum, Sunflower, Tomato, Maize.**

**Ans:** Xanthium: (SDP)

Henbane (Hyoscyamus niger): (LDP)

Spinach: (LDP)

Rice: (SDP)

Strawberry: (SDP)

Bryophyllum: LSDP (Long short day plants)

Sunflower: (DNP)

Tomato: (DNP)

Maize: (DNP)

**Q7. A farmer grows cucumber plants in his field. He wants to increase the number of female flowers in them. Which can plant growth regulator be applied to achieve this?**

**Ans:** Ethylene (C<sub>2</sub>H<sub>4</sub>)

**Q8. Where are the following hormones synthesised in plants?**

**a. IAA**

**b. Gibberellins**

**c. Cytokinins**

**Ans:** a. IAA: Shoot tips and apical bud

b. Gibberellins: Root tips and young leaves

c. Cytokinins: Meristematic zones like root tips

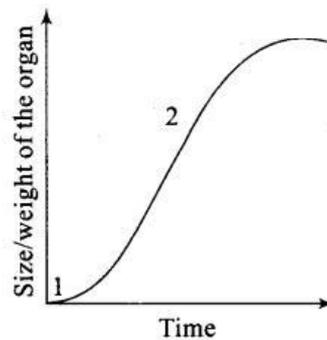
**Q9. In botanical gardens and tea gardens, gardeners trim the plants regularly so that they remain bushy. Does this practice have any scientific explanation?**

**Ans:** Mostly in higher plants, the growing apical bud inhibits the growth of the lateral (axillary) buds, a phenomenon called apical dominance. Removal of shoot tips (decapitation) usually results in the growth of lateral buds. Hence, in botanical gardens and tea gardens, gardeners trim the plants regularly so that they remain bushy.

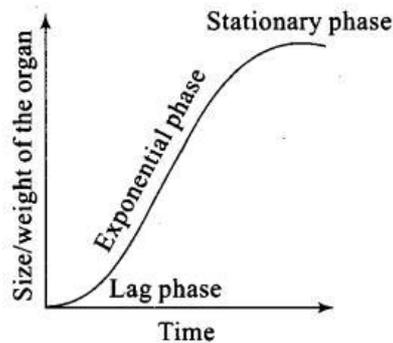
**Q10. Light plays an important role in the life of all organisms. Name any three physiological processes in plants which are affected by light.**

**Ans:** Photoperiodism, phototropism and photosynthesis.

**Q11. In the figure of Sigmoid growth curve given below, label segments 1,2 and 3**



**Ans.**



**Q12. Growth is one of the characteristics of all living organisms. Do unicellular organism also grow? If so, what are the parameters?**

**Ans:** Increase in mass and increase in number of individuals are twin characteristics of growth. A multicellular organism grows by cell division. Unicellular organisms grow by cell division. One can easily observe this in in vitro cultures by simply counting the number of cells under the microscope.

**Q13. The rice seedlings infected with fungus Gibberella fujikuroi is called foolish seedlings? What was the reason behind it?**

**Ans:** The rice seedling infected with fungus Gibberella fujikuroi is called foolish seedlings because the fungus secreted a hormone gibberellin and causes excessive growth of rice plants. Plants become tall but unable to produce seeds so they are called foolish.

#### Short Answer Type Questions

**Q1. Nicotiana tobacum, a short-day plant, when exposed to more than critical period of light fails to flower. Explain.**

**Ans:** a. Some plants require a periodic exposure to alternate light and dark for its flowering response. This phenomenon is termed photoperiodism.

b. The requirement of light exposure is critical. The SDP plants, when exposed to light period

in excess of critical period fail to flower,

c. Those plants which require exposure to light period at critical or more than critical period for its flowering response are called long-dayplant.

d. *Nicotiana tabacum* fails to flower if exposed to more than critical period of light because it is an SDP.

**Q2. What are the structural characteristics of**

**a. Meristematic cells near root tip**

**b. The cells in the elongation zone of the root**

**Ans:** a. The meristematic cells near root tip are characterised by

- rich protoplasm
- large conspicuous nucleus
- thin and cellulose cell wall -primary in nature
- fewer vacuoles
- greater number of mitochondria
- numerous (abundant) plasmodesmata

b. The cells in the elongation zone of a root are characterized by

- increased vacuolation
- enlarged size/dimension
- deposition of new cellulose cell walls

**Q3. Does the growth pattern in plants differ from that in animals? Do all the parts of plant grow indefinitely? If not, name the regions of plant, which can grow indefinitely.**

**Ans:** Yes, the growth pattern in plants differ from that in animals. 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.

**Q4. Explain in 2-3 lines each of the following terms with the help of examples taken from different plant tissues.**

**a. Differentiation**

**b. De-differentiation**

**c. Re-differentiation**

**Ans:** a. Differentiation: The cells derived from root apical and 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 few to major structural changes both in their cell walls and protoplasm. For 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 even under extreme tension.

b. De-differentiation: 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 de-differentiation. For example, formation of meristems – interfascicular cambium and cork cambium from fully differentiated parenchyma cells.

c. Re-differentiation: While doing de-differentiation, such meristems/ tissues are able to divide and produce cells that once again lose the capacity to divide but mature to perform specific functions, i.e., get re-differentiated, e.g., secondary xylem and secondary cortex.

**Q5. Auxins are growth hormones capable of promoting cell elongation. They have been used in horticulture to promote growth, flowering and rooting. Write a line to explain the meaning of the following terms related to auxins.**

**a. Auxin precursors**

**b. Anti-auxins**

**c. Synthetic auxins**

**Ans:** a. Auxin precursors: The substances that produce the auxin are called auxin precursors.

For example, tryptophan is the auxin precursor.

b. Anti-auxins: The substances which inhibit the synthesis or transport of auxin are called anti-auxins. For example, TIBA (Triiodobenzoic acid) is anti-auxin compound.

c. Synthetic auxins: The artificially synthesised chemicals having auxin-like property are called synthetic auxins. For example, NAA

– (Naphthalene acetic acid) and 2, 4-D (2, 4-Dichloro phenoxyacetic acid).

**Q6. The role of ethylene and abscisic acid is both positive and negative. Justify the statement.**

**Ans:** Positive roles of ethylene: Influences of ethylene on plants include horizontal growth of seedlings, swelling of the axis and apical hook formation in dicot seedlings. Ethylene breaks seed and bud dormancy, initiates germination in peanut seeds, sprouting of potato tubers.

• Negative roles of ethylene: Ethylene promotes senescence and abscission of plant organs especially of leaves and flowers.

• Positive roles of abscisic acid: ABA plays an important role in seed development and maturation.

• Negative roles of abscisic acid: It acts as a general plant growth inhibitor and an inhibitor of plant metabolism. ABA inhibits seed germination. ABA stimulates the closure of stomata in the epidermis and increases the tolerance of plants to various kinds of stresses.

**Q7. While experimentation, why do you think it is difficult to assign any effect seen to any single hormone?**

**Ans:** Many hormones have synergistic and antagonistic effect with each other. So, while experimentation, it is difficult to assign any effect seen to any single hormone.

**Q8. What is the mechanism underlying the phenomenon by which the terminal/ apical bud suppresses the growth of lateral buds? Suggest measures to overcome this phenomenon.**

**Ans:** The phenomenon by which the terminal/apical bud suppresses the growth of lateral buds is called apical dominance. Apical dominance is due to auxin hormone secreted by apical buds. This can be overcome by decapitation (removal of apical buds) or the application of cytokinin.

**Q9. In animals there are special glands secreting hormones, whereas there are no glands in plants. Where are plant hormones formed? How are the hormones translocated to the site of activity?**

**Ans:** In plants, the hormones are formed by different tissues like shoot tips, root tips, meristematic tissues, leaves and apical buds, etc.

Hormones are translocated to the site of activity by vascular tissues (xylem and phloem)

**Q10. Many discoveries in science have been accidental. This is true for plant hormones also. Can you justify this statement by giving an example? Also what term is used for such accidental findings?**

**Ans:** The discovery of each of the five major groups of PGRs have been accidental. All this started with the observation of Charles Darwin and his son Francis Darwin when they observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards the light source (phototropism). After a series of experiments, it was concluded that the tip of coleoptile was the site of transmittable influence that caused the bending of the entire coleoptile. Auxin was isolated by F.W. Went from tips of coleoptiles of oat seedlings. Such accidental findings or discoveries are known as serendipity.

**Q11. To get carpet-like grass lawn are mowed regularly. Is there any scientific explanation for this?**

**Ans:** To get a carpet-like grass lawns are mowed regularly because mowing causes decapitation which promotes the growth of lateral buds.

**Q12. In a slide showing different types of cells, can you identify which type of the cell may be meristematic and the one which is incapable of dividing and how?**

**Ans:** The meristematic cells are rich in protoplasm, possess large conspicuous nuclei. Their cell walls are primary in nature, thin and cellulosic with abundant plasmodesmatal connections. Cells incapable of dividing attain their maximal size in terms of wall thickening and protoplasmic modifications.

**Q13. A rubber band stretches and reverts back to its original position. Bubble gum stretches, but it would not return to its original position. Is there any difference between the two processes? Discuss it with respect to plant growth (Hint: Elasticity (reversible), Plasticity (irreversible))**

**Ans:** A rubber band stretches and reverts back to its original position, it is due to elasticity. Bubble gum stretches, but it would not return to its original position, this is due to plasticity.

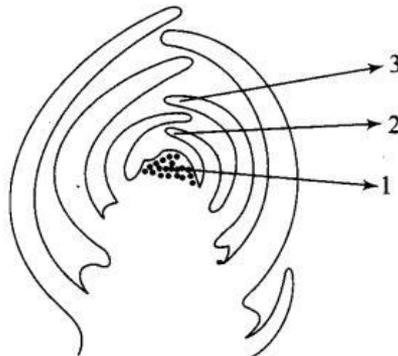
• The meristematic cells are rich in protoplasm, possess large conspicuous nuclei. Their cell walls are primary in nature, thin, cellulosic and elastic with abundant plasmodesmatal connections.

• Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called plasticity, e. g., heterophylly in cotton, coriander and larkspur. In such plants, the leaves of the juvenile plant are different in shape from those in mature plants.

**Q14. Label the diagram**

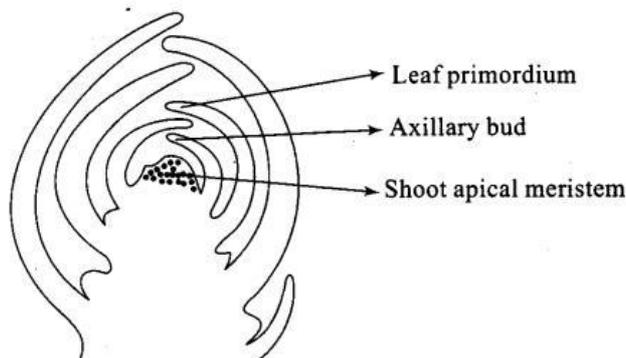
**a. This is which part of a dicotyledonous plant?**

**b. If we remove part 1 from the plant, what will happen?**



**Ans. a. Shoot apical meristem**

**b. Removal of shoot apical meristem causes inhibition of apical bud and growth of axillary buds.**



**Q15. Both animals and plants grow. Why do we say that growth and differentiation in plants is open and not so in animals? Does this statement hold true for sponges also?**

**Ans:** 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

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activity of the meristem is called the open form of growth. Yes, this statement holds true for sponges also.

**Q16. Define parthenocarpy. Name the plant hormone used to induce parthenocarpy.**

**Ans:** Most fruits however develop only from the ovary and are called true fruits.

Although in most of the species, fruits are the results of fertilisation, there are a few species in which fruits develop without fertilisation. Such fruits are called parthenocarpic fruits. Banana is one such example. Parthenocarpy can be induced through the application of growth hormones (like gibberellin and auxin) and such fruits are seedless. Auxins induce parthenocarpy in tomatoes.

**Q17. While eating watermelons, all of us wish it was seedless. As a plant physiologist can you suggest any method by which this can be achieved.**

**Ans:** This can be achieved through parthenocarpy. Parthenocarpy can be induced through the application of growth hormones (like gibberellin and auxin) and such fruits are seedless.

**Q18. A gardener finds some broad-leaved dicot weeds growing in his lawns. What can be done to get rid of the weeds efficiently?**

**Ans:** The dicotyledonous plants grow by their apical shoot meristems while grasses (which make lawns) possess intercalary meristem. Certain auxins, such as synthetic 2, 4-Dichlorophenoxyacetic acid (2,4-D) when applied in excess can damage the shoot apical meristems but they do not cause any damage to the intercalary meristems. Thus, when 2, 4-D is sprayed on lawns, only the dicots get killed and the lawns become free of weeds.

**Q19. On germination a seed first produces shoots with leaves, flowers appear later, a. Why do you think this happens?**

**b. How is this advantageous to the plant?**

**Ans:** a. All organisms have to reach a certain stage of growth and maturity in their life, before they can reproduce sexually. That period of growth is called the juvenile phase. It is known as vegetative phase in plants. This phase is of variable durations in different organisms. The end of juvenile/ vegetative phase which marks the beginning of the reproductive phase can be seen easily in the higher plants when they come to flower.

b. This enables the plant to have sufficient time to reach maturity.

**Q20. Fill in the blanks:**

**a. Maximum growth is observed in phase.**

**b. Apical dominance is due to .**

**c. initiate rooting. .**

**d. Pigment involved in Photoperception in flowering plants is .**

**Ans:** a. Maximum growth is observed in log/exponential phase.

b. Apical dominance is due to auxin.

c. Auxins initiate rooting.

d. Pigment involved in Photoperception in flowering plants is phytochrome.

### Long Answer Type Questions ‘

**Q1. Some varieties of wheat are known as spring wheat while others are called winter wheat. Former variety is sown, and planted in spring and is harvested by the end of the same season. However, winter varieties, if planted in spring, fail to flower or produce mature grains within a span of a flowering season. Explain, why?**

**Ans:** There are plants for which flowering is either quantitatively or qualitatively dependent on exposure to low temperature. This phenomenon is termed vernalisation. It prevents precocious reproductive development late in the growing season, and enables the plant to have sufficient time to reach maturity. Vernalisation refers specially to the promotion of flowering by a period of low temperature. Some important food plants, wheat, barley, rye have two kinds of varieties: winter and spring varieties. The ‘spring’ variety are normally planted in the spring and come to flower and produce grain before the end of the growing season. Winter varieties, however, if planted in spring would normally fail to flower or produce mature grain within a span of a flowering season. Hence, they are planted in autumn. They germinate, and over winter come out as small seedlings, resume growth in the spring, and are harvested usually around mid-summer.

**Q2. It is known that some varieties of wheat are sown in autumn but are harvested around next mid-summer.**

**a. ■ What could be the probable reason for this?**

**b. What term is used for this promotion of flowering under low temperature?**

**c. Which plant hormone can replace the cold treatment?**

**Ans:** a. Winter varieties, if planted in spring would normally fail to flower or produce mature grain within a span of a flowering season. Hence, they are planted in autumn. They germinate, and over winter come out as small seedlings, resume growth in the spring, and are harvested usually around mid-summer.

b. Vernalisation

c. Gibberellin

**Q3. Name a hormone which**

**a. is gaseous in nature**

**b. is responsible for phototropism**

**c. induces femaleness in flowers of cucumber**

**d. is used for killing weeds (dicots)**

**e. induces flowering in long day plants**

**Ans:** a. Gaseous in nature: Ethylene (C<sub>2</sub>H<sub>4</sub>)

b. Responsible for phototropism: Auxin

c. Induces femaleness in flowers of cucumber: Ethylene (C<sub>2</sub>H<sub>4</sub>)

d. Used for killing weeds (dicots): Auxin

e. Induces flowering in long day plants: Gibberellin