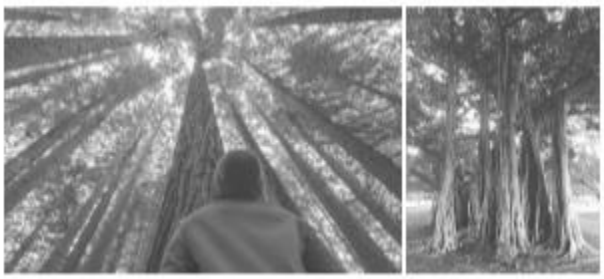
Plant Growth and Development

Case Study Based Questions

Read the following passages and answer the questions that follow:

1. Rohit is a curious kid having good knowledge of plants. One day, he was watching two plants, the first one being very tall and the second one had thick stems. The first plant is redwood, which is one of the tallest plants in the world, and the second plant is the banyan tree. Both of these plants are grown in the same area, suffering from the same climatic conditions, and the same human care. Rohit is having a problem and is confused due to the difference in the morphology of both plants. Help Rohit.



(A) What are the two types of growth seen here?
(B) Which type of growth is predominant in each plant?
(C) Write one difference and one similarity between these two types of growth.

Ans. (A) Primary growth and secondary growth.
(B) In the first plant, primary growth is predominant, and in the second plant, secondary growth is predominant.
(C) Difference: In primary growth, the length of the plant increases, whereas in secondary growth the girth of the plant increases.
Similarity: In both of these growths, meristematic tissues are involved.

2. Guava is one of the most important fruits of India, it is considered to be a poor man's apple. The guava tree is a native of Tropical America, but now it is found in all parts of the tropics. Guava is cultivated in 148200 hectares (ha), with a production of 163 million

tons all over the country.

(A) What are the factors the plant was lacking?

(a) Water

(b) Light

(c) Soil nutrients

(d) Both (a) and (b)

(B) What is the role of water in the growth of plants?

(a) Maintains turgidity of cell.

(b) Provide a medium for enzymatic activity.

(c) Production of energy.

(d) Both (a) and (b).

(C) What is the role of light in the growth of plants?

(a) Synthesis of photosynthetic pigments.

(b) Maintains turgidity of cell.

(c) Synthesis of protoplasm.

(d) None of the above.

(D) What are the other factors that affect the growth of plants?

(a) Light

(b) Temperature

(c) Hormones

(d) All of these

(E) The correct chronological sequence of developmental stages in plants:

(a) Germination →→ Vegetative growth → Flowering → Fruiting

(b) Flowering → Fruiting → Germination → Vegetative growth

(c) Germination → Flowering Vegetative growth → Fruiting
(d) Flowering Fruiting Vegetative growth → Germination

Ans. (A) (d) Both (a) and (b)
Explanation: Since leaves of plants have wilted so, it means transferred plant is not getting enough water. The plant was also kept in dark which indicates that the plant was not getting any sunlight.
(B) (d) Both (a) and (b)
Explanation: Water helps to maintain the turgidity of cells and also provides a medium for enzymatic activity.
(C) (a) Synthesis of photosynthetic pigments
Explanation: Sunlight is required for the synthesis of photosynthetic pigments like chlorophyll.
(D) (d) All of the above
Explanation: Light, temperature, and phytohormones, all are important factors that affect the growth of plants.
(E) (a) Germination → Vegetative growth
→ Flowering → Fruiting.

3. Ethylene is a straightforward gaseous PGR. It is produced in huge quantities by senescent tissues and ripening fruits. Horizontal seedling growth, axis swelling, and apical hook development in dicot seedlings are all effects of ethylene on plants. Ethylene is a gaseous phytohormone and the first of this hormone class to be discovered. It is the simplest olefin gas and is biosynthesized by plants to regulate plant development, growth, and stress responses via a well-studied signalling pathway. One of the earliest reported responses to ethylene is the triple response. This response is common in dicot seedlings grown in the dark and is characterised by reduced growth of the root and hypocotyl, an exaggerated apical hook, and a thickening of the hypocotyl.
(A) Given below are the names of a few compounds. Which of them is used as a source of ethylene?
(a) Enamides
(b) Ethephon
(c) Enol
(d) Ethers
(B) Which statement is incorrect?

(a) Ethylene can cause fruit ripening.
(b) Ethylene helps in root growth and root hair formation.
(c) Ethylene induces parthenocarpy in tomatoes.
(d) Ethylene causes flowering in mango.

(C) Ethylene enhances the respiration rate during the ripening of fruits. This is called:

(a) Respiratory climactic
(b) Climatic respiration
(c) Climatic breathing
(d) None of the above

(D) Which of the following PGRS is one of the most commonly used in agriculture?

(a) ABA
(b) Auxins
(c) Cytokinins
(d) Ethylene

(E) How does ethylene help deepwater rice plants?

(a) Promoting female flowers
(b) Germination in their seeds
(c) Internode elongation
(d) Apical hook formation

Ans. (A) (b) Ethephon
Explanation: Ethephon is widely used as a source of ethylene as it is readily absorbed in aqueous solutions and is transported within the plants. It then releases ethylene slowly.
(B) (c) Ethylene induces parthenocarpy in tomatoes.
Explanation: Ethylene is used for fruit ripening, root growth and root hair formation, and it causes flowering in mango. But ethylene does not induce parthenocarpy in tomatoes, this is caused by auxins.
(C) (a) Respiratory climactic
Explanation: Ethylene is an excellent ripening agent. By raising the rate of respiration, it speeds up the ripening of the fruit. This is called the respiratory climactic.
(D) (d) Ethylene
Explanation: Ethylene regulates many physiological processes and so it is one of the most widely used PGRS in agriculture and horticulture.

(E) (c) Internode elongation
Explanation: Ethylene helps deepwater rice plants by promoting fast petiole or internode elongation.

4. PGRS are classified into two groups based on their functions in the living plant body. These are Plant Growth Promoters and Plant Growth Inhibitors. Growth-promoting mechanisms include cell division, cell expansion, pattern creation, tropic growth, flowering, fruiting and seed generation. Plant growth promoters include auxins, gibberellins, and cytokinins. The PGRS of the other group impact plant responses to wounds and biotic and abiotic stresses. They are also involved in growth- slowing processes like dormancy and abscission. PGR abscisic acid is a member of this group. ABA is purely a plant growth Inhibitor hormone. Ethylene, a gaseous PGR, can fall under either of these categories, but its primary function is to impede growth.
(A) Describe the observation of Charles and Francis Darwin.
(B) Which PGR was isolated by F.W. Went from oat seedlings?
(C) (i) A fungal pathogen caused the disease of rice seedlings known as 'bakane'. Name the fungal pathogen and name the scientist who reported this.
(ii) Inhibitor-B, abscission II and dormin were proved to be chemically identical later. What was the common name given to them?

Ans. (A) Charles Darwin and his son Francis Darwin discovered that the coleoptiles of canary grass bend towards the light source when exposed to unilateral illumination (phototropism). Following a series of trials, it was determined that the coleoptile's tip was the source of the transmittable effect that caused the entire coleoptile to bend.
(B) Auxin was isolated by F.W. Went from oat seedlings.
(C)(i) The name of the fungal pathogen is Gibberella fujikuroi. E. Kurosawa reported the symptoms of the disease in the uninfected rice seedlings when they were treated with sterile filtrates of the fungus.
(ii) The common name given to these chemically identical compounds was abscisic acid or ABA.