Plant Growth and Mineral Nutrition

EXERCISES [PAGES 151 - 152]

Exercises | Q 1.01 | Page 151

Multiple choice question.

Which of the hormones can replace vernalization?

1. Auxin
2. Cytokinin
3. **Gibberellins**
4. Ethylene

Solution: Gibberellins

Exercises | Q 1.02 | Page 151

Multiple choice question.

The principle pathway of water translocation in angiosperms is _____

1. Sieve cells
2. Sieve tube elements
3. **Xylem**
4. Xylem and phloem

Solution: The principle pathway of water translocation in angiosperms is **Xylem.**

Exercises | Q 1.03 | Page 151

Multiple choice question.

Abscisic acid controls _____.

1. cell division
2. **leaf fall and dormancy**
3. shoot elongation
4. cell elongation and wall formation

Solution: Abscisic acid controls **leaf fall and dormancy**.

Exercises | Q 1.04 | Page 151

Multiple choice question.

Which is employed for the artificial ripening of banana fruits?

1. Auxin
2. **Ethylene**
3. Cytokinin
4. Gibberellin

Solution: Ethylene

Exercises | Q 1.05 | Page 151

Multiple choice question.

Which of the following is required for stimulation of flowering in the plants?

1. Adequate oxygen
2. **Definite photoperiod**
3. Adequate water
4. Water and minerals

Solution: Definite photoperiod

Exercises | Q 1.06 | Page 151

Multiple choice question.

For short-day plants, the critical period is

1. light
2. **dark/ night**
3. UV rays
4. both light and UV rays

Solution: For short-day plants, the critical period is **dark/ night.**

Exercises | Q 1.07 | Page 151

Multiple choice question.

Which of the following is day-neutral plant?

a. Tomato

b. Cotton

c. Sunflower

d. Soybean

Solution: a. Tomato and c. Sunflower

Exercises | Q 1.08 | Page 151

Multiple choice question.

Essential macroelements are _____.

1. manufactured during photosynthesis
2. produced by enzymes
3. **absorbed from soil**
4. produced by growth hormones

Solution: Essential macroelements are **absorbed from soil.**

Exercises | Q 1.09 | Page 151

Multiple choice question.

Function of Zinc is _____.

1. closing of stomata
2. **biosynthesis of 3-IAA**
3. synthesis of chlorophyll
4. oxidation of carbohydrates

Solution: Function of Zinc is **biosynthesis of 3-IAA.**

Exercises | Q 1.1 | Page 151

Multiple choice question.

Necrosis means _____.

1. yellow spots on the leaves
2. **death of tissue**
3. darkening of green colour in leaves
4. wilting of leaves

Solution: Necrosis means **death of tissue.**

Exercises | Q 1.11 | Page 151

Multiple choice question.

Conversion of nitrates to nitrogen is called _____

1. ammonification
2. nitrification

3. nitrogen fixation
4. **denitrification**

Solution: Conversion of nitrates to nitrogen is called **denitrification.**

Exercises | Q 1.12 | Page 151

Multiple choice question.

How many molecules of ATP are required to fix one molecule of nitrogen?

1. 12
2. 20
3. 6
4. **16**

Solution: 16

Exercises | Q 2.01 | Page 151

Very Short Answer Question:

Enlist the phases of growth in plants?

Solution:

Three phases of growth in plants are:

i. Phase of cell division/ formation

ii. Phase of cell enlargement/ elongation

iii. Phase of cell maturation/ differentiation.

Exercises | Q 2.02 | Page 151

Very Short Answer Question:

Give the full form of IAA?

Solution: IAA: Indole-3-acetic acid

Exercises | Q 2.03 | Page 151

Very Short Answer Question:

What does it mean by ‘open growth’?

Solution:

The form of growth where in new cells are being constantly added to the plant body by the activity of the meristem is called the open growth.

Exercises | Q 2.04 | Page 151

Very Short Answer Question:

Which is the plant stress hormone?

Solution:

Abscisic acid (ABA) is the plant stress hormone

Exercises | Q 2.05 | Page 151

Very Short Answer Question:

What is denitrification?

Solution:

i. Denitrification is the process in which anaerobic bacteria convert soil nitrates back into nitrogen gas.

ii. Denitrifying bacteria removes fixed nitrogen i.e. nitrates from the ecosystem and returns it to the atmosphere in an inert form.

iii. Denitrifying bacteria include Bacillus spp., Paracoccus spp. and Pseudomonas denitrificans. They transform nitrates to nitrous and nitric oxides and ultimately to gaseous nitrogen.

$2NO_3 \rightarrow 2NO_2 \rightarrow 2NO \rightarrow N_2$

Exercises | Q 2.06 | Page 151

Very Short Answer Question:

Name the bacteria responsible for conversion of nitrite to nitrate.

Solution:

Chemoautotrophs like Nitrobacter are responsible for conversion of nitrite to nitrate.

Exercises | Q 2.07 | Page 151

Very Short Answer Question:

What is role of gibberellin in rosette plants?

Solution:

Gibberellin promotes bolting i.e. elongation of internodes just prior to flowering in plants with rosette habit e.g. beet, cabbage.

Exercises | Q 2.08 | Page 151

Very Short Answer Question:

Define vernalization.

Solution:

The low-temperature treatment or chilling treatment of germinating seeds or seedlings to promote early flowering in plants is called vernalization. It was evidenced by Klippart (1918).

Exercises | Q 2.09 | Page 151

Very Short Answer Question:

Define photoperiodism.

Solution:

The relative length of the day which is crucial in the growth and development of flowers is termed as photoperiodism.

OR

The response of plants to the relative length of light and dark periods with reference to the initiation of flowering is called photoperiodism.

Exercises | Q 2.1 | Page 151

Very Short Answer Question:

What is a grand period of growth?

Solution:

The total time (period) required for all phases to occur, is called Grand Period of Growth.

Exercises | Q 3.1 | Page 152

Short Answer Question:

Write a short note on Differentiation.

Solution:

1. It is maturation of cells derived from the apical meristem of root and shoot.

2. Permanent change in structure and function of cells leading to maturation is called differentiation.

3. During cell differentiation, the cell undergoes few to major anatomical and physiological changes.

4. For e.g. Parenchyma in hydrophytes develops large schizogenous interspaces for mechanical support, buoyancy and aeration.

5. Cells lose the capacity to divide and redivide and mature.

Exercises | Q 3.1 | Page 152

Short Answer Question:

Write a short note on Re-differentiation.

Solution:

1. The cells produced by dedifferentiation once again lose the capacity to divide and mature to perform a specific functions. This is called a re-differentiation.

2. For e.g. secondary xylem and secondary phloem are formed from dedifferentiated cambium present in the vascular bundle.

Exercises | Q 3.2 | Page 152

Short Answer Question:

Differentiate between Arithmetic and Geometric growth.

Solution:

Arithmetic growth	Geometric growth
After mitosis one of the daughter cell continues to divide and the other cell takes part in the differentiation and maturation.	After mitosis both the daughter cells continue to divide and re-divide repeatedly.
On plotting the growth against time, a linear curve is obtained.	On plotting the growth against time, a sigmoid curve is obtained.

Exercises | Q 3.3 | Page 152

Short Answer Question:

Enlist the role and deficiency symptoms of Nitrogen.

Solution:

Nitrogen:

a. Role: Constituent of proteins, nucleic acids, vitamins, hormones, coenzymes, ATP, chlorophyll.

b. Deficiency symptom: Stunted growth, chlorosis

Exercises | Q 3.3 | Page 152

Short Answer Question:

Enlist the role and deficiency symptoms of Phosphorus.

Solution:

Phosphorus:

a. Role: Constituent of cell membrane, certain proteins, all nucleic acids, and nucleotides required for all phosphorylation reactions.

b. Deficiency symptom: Poor growth, leaves dull green.

Exercises | Q 3.3 | Page 152

Short Answer Question:

Enlist the role and deficiency symptoms of Potassium.

Solution:

Potassium:

a. Role: Helps in determining anion- cation balance in cells involved in protein synthesis, involved in the formation of the cell membrane and in opening and closing of stomata; increases hardness; activates enzymes, and helps in the maintenance of turgidity of cells.

b. Deficiency symptom: Yellow edges to leaves, premature death.

Exercises | Q 3.4 | Page 152

Short Answer Question:

What is short day plant? Give any two examples.

Solution:

1. Critical photoperiod is the length of photoperiod above or below which flowering occurs. Short Day Plants usually flower during winter and late summer when day length is shorter than the critical photoperiod.

2. These are called long night plants because they require long uninterrupted dark period/ night for flowering.

3. If the dark period is interrupted even by a flash of light, SDP will not flower.

4. Some of the short-day plants are Dahlia, Tobacco, Chrysanthemum, Soybean (Glycine max), Cocklebur (Xanthium), cotton, etc.

Exercises | Q 3.5 | Page 152

Short Answer Question:

What is vernalization? Give its significance.

Solution:

1. The low-temperature treatment or chilling treatment of germinating seeds or seedlings to promote early flowering in plants is called vernalization. It was evidenced by Klippart (1918).

2. Chouard (1960) defined vernalization as the acceleration of the ability to flower by chilling treatment.

3. The term vernalization was coined by T.D Lysenko (1928) for the effect of low temperature on flowering in plants.

4. It is an influence of temperature on development and flowering.

5. Many plants such as cereals, crucifers require a period of cold treatment for flowering.

6. It is the method of inducing early flowering in the plants by pretreatment to their seeds/ seedlings at low temperatures (1-6ºC for one to one and half months' duration).

7. The site of vernalization is believed to shoot apical meristem.

8. Generally, vernalization is effective at the seed stage in annual plants.

9. It was suggested by Melchers (1939) that vernalization initiates a stimulus for the formation of a hormone called vernalin.

10. **Significance of vernalization:**

a. Crops can be produced earlier.

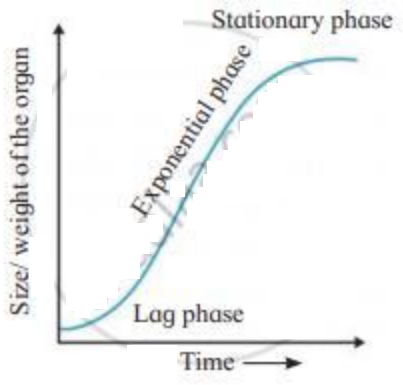
b. Crops can be cultivated in regions where they do not grow naturally.

Exercises | Q 4.1 | Page 152

Long Answer Question:

Explain sigmoid growth curve with the help of diagram.

Solution:



1. The curve obtained when a graph of growth rate against time is plotted for three phases of growth is called as a sigmoid curve.

2. Growth rate differs with three distinct phases of growth.

3. In the Lag phase, the growth rate is slow.

4. In Exponential (Log) phase, growth rate is faster and reaches its maximum.

5. In Stationary phase, growth rate gradually slows down.

Exercises | Q 4.2 | Page 152

Long Answer Question:

Describe the types of plants on the basis of photoperiod required, with the help of suitable examples.

Solution:

Based on the photoperiodic response, plants were classified into three categories viz. Short Day Plants (SDP), Long Day Plants (LDP) and Day Neutral Plants (DNP).

1. Short Day Plants (SDP):

i. Critical photoperiod is the length of photoperiod above or below which flowering occurs. Short Day Plants usually flower during winter and late summer when day length is shorter than the critical photoperiod.

ii. These are called long night plants because they require long uninterrupted dark period/ night for flowering.

iii. If dark period is interrupted even by a flash of light, SDP will not flower.

iv. Some of the short-day plants are Dahlia, Tobacco, Chrysanthemum, Soybean (Glycine max), Cocklebur (Xanthium), cotton, etc.

2. Long Day Plants (LDP):

i. Plants that flower during summer are called long-day plants.

ii. They require a longer duration of light than the critical photoperiod, for flowering.

iii. They are called short night plants as they require a short dark period.

iv. When long dark period is interrupted by a brief flash of light, LD plants can flower e.g. pea, radish, sugar beet, cabbage, spinach, wheat, poppy, etc.

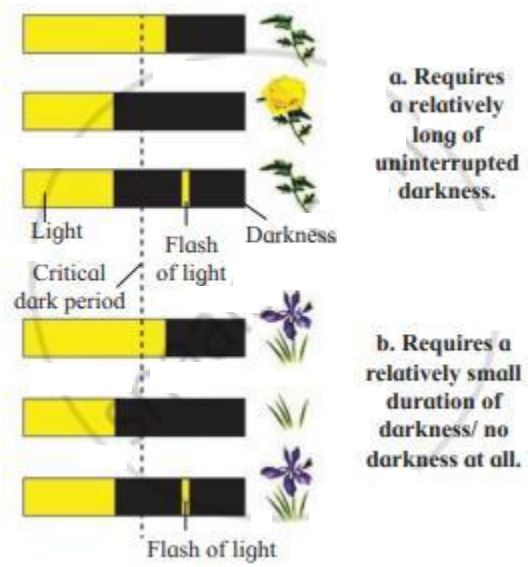
3. Day Neutral Plants (DNP):

a. These plants flower throughout the year-round, independent of the duration of light (photoperiod).

b. They do not require specific photoperiod to flower.

c. Therefore, they are called day-neutral plants e.g. Cucumber, tomato, sunflower, maize, balsam, etc.

Photoperiodism-



Exercises | Q 4.3 | Page 152

Long Answer Question:

Explain biological nitrogen fixation with example.

Solution:

Biological nitrogen fixation:

i. It is carried out by prokaryotes called as ‘Nitrogen fixers’ or Diazotrophs’.

ii. It accounts for nearly 70% of natural nitrogen fixation.

iii. Nitrogen fixers are either symbiotic or free living.

iv. Symbiotic N_2 fixation:
The best-known nitrogen-fixing symbiotic bacterium is Rhizobium. This soil living/ dwelling bacterium forms root nodules in plants belonging to the family Fabaceae e.g. beans, gram, groundnut etc.

v. Azotobacter, Azospirillum is free-living nitrogen-fixing bacteria.

vi. The cyanobacteria fix a significant amount of nitrogen in specialized cells called heterocysts.

vii. Nitrogen fixation is high energy-requiring process and nitrogen fixers use 16 molecules of ATP to fix each molecule of nitrogen to form ammonia.

$N_2 + 8H^+ + 8e^- + 16ATP \rightarrow 2NH_3 + H_2 + 16ADP + 16Pi$