Let us Practice

Exercise I

1. Using the information given in figure, select the best answer.
   Increase in light intensity

   ![Graph showing the rate of photosynthesis at different CO₂ levels and temperatures](image)

   (a) cause an increase in photosynthetic rate at higher temperature only
   (b) cause an increase in photosynthetic rate at lower temperature only
   (c) cause an increase in photosynthetic rate at low CO₂ level only
   (d) cause an increase in photosynthetic rate at higher CO₂ level only

2. In a girdling experiment, a complete ring of phloem tissue was removed at some height from
   ground. When sugar content of the phloem tissue above and below the ring was compared with
   another normal (non-ringed) plant, given two graphs were obtained. Mark the correct interpretation
   (2nd NSEB)
   (a) Graph ‘A’ depicts the sugar content of phloem just below the ring
   (b) Graph ‘B’ depicts the sugar content of phloem above the ring and a long distance apart
   (c) Graph ‘A’ depicts sugar level in phloem just above the ring
   (d) Both graphs ‘A’ and ‘B’ depict the sugar content of phloem above the ring but a long distance apart

3. The living tissue that provides support to the growing parts of the plant is
   (2nd NSEB)
   (a) sclerenchyma  (b) collenchyma
   (c) parenchyma  (d) fibres

4. Mechanism by which the minerals enter the root cells without the use of ATP, is
   (1st NSEB)
   (a) transpiration pull
   (b) ion exchange
   (c) carrier transport
   (d) vein loading

5. With reference to the bark, which one of the following statements is false?
   (a) It is tissue which is living
   (b) It is a tissue external to innermost phellogen
   (c) Protects loss of water
   (d) Protects the tree from infection

6. Callus exposed to low auxin and moderate cytokinin concentration will result in
   (4th NSEB)
   (a) multiple shoots  (b) roots
   (c) plantlets  (d) no change

7. On girdling which part of the plant will die first?
   (a) Root  (3rd NSEB)
   (b) Shoot
   (c) Both-root and shoot simultaneously
   (d) Plant continues to live as such
8. The movements of the Venus flytrap are controlled by
   (a) auxins
   (b) ethylene
   (c) internal regulators
   (d) rapid elongation and retraction of cells

9. Major part of wood of old dicot stem is filled with tannins, resins and gums. This part is called
   (a) heart wood
   (b) soft wood
   (c) sap wood
   (d) hard wood

10. In the stelar evolution, the type of stelae that is highly evolved is
    (a) dictyoステル
    (b) haplotele
    (c) solanoste
    (d) atactoste

11. The major function of sieve tubes in plants is
    (a) mechanical support
    (b) translocation of water and minerals
    (c) translocation of organic solutes
    (d) food storage

12. Of the water absorbed by the roots of a typical C_3 plant, around how much is split and results in the production of O_2?
    (a) 0.01%
    (b) 1%
    (c) 25%
    (d) 90%

13. There is only one female Borassas palm on an island and no male palms. There are a few male Borassas palms on a nearby island. Birds fly frequently between these two islands. The female palm fruits regularly every season. What is the agent of pollination?
    (a) Water
    (b) Air
    (c) Birds
    (d) None of these

14. In ripening fruit, photosynthetic chloroplast becomes non-photosynthetic
    (a) chromoplast
    (b) leucoplast
    (c) apoplast
    (d) symplast

15. Issue in plant seeds that serves the same function as yolk in chicken embryos is
    (a) seed coat
    (b) endosperm
    (c) epicotyl
    (d) embryo

16. \[2\text{NH}_3 + 3\text{O}_2 \rightarrow 2\text{NHO}_2 + 2\text{H}_2\text{O} + \text{energy}\]
    This reaction nitrifying bacteria indicates that they are
    (a) photoautotrophic
    (b) chemoautotrophic
    (c) photoheterotrophic
    (d) chemoheterotrophic

17. The mineral element in chlorophyll and haemoglobin is respectively
    (a) Ca and Mg
    (b) Co and Fe
    (c) Mg and Fe
    (d) Cd and Fe

18. Consider the following statements regarding angiosperms and choose the combination of correct statements from among them:
   I. As a rule, only one pollen tube is formed in a pollen grain.
   II. The protoplast of the pollen grain migrates out and positions itself at the tip of the pollen tube.
   III. Backward flow of cytoplasm from the tip of the pollen tube towards the microspore prevented by formation of callose plug.
    (a) I, II and III
    (b) I and III
    (c) II and III
    (d) I and II

19. In the leaves of C_3 plants, the cells that normally contain chlorophyll are
    (a) palisade mesophyll cells
    (b) bundle sheath cells
    (c) lower epidermal cells
    (d) endodermal cells

20. Flower with a feathery and sticky stigma, numerous light pollen, reduced petals characteristic of
    (a) moth/pollinated flower
    (b) bird/pollinated flower
    (c) bee/pollinated flower
    (d) wind/pollinated flower

21. Removal of cork from the trees is to be done with care. Otherwise the tree can die. This is because
    (a) the xylem layer transporting water and minerals can be damaged
    (b) the primary rays giving strength can be damaged
    (c) the inner pith with storage cells can be damaged
    (d) the phloem used in transporting the sugar can be damaged

22. The nitrogen content of cotyledons is likely to reduce during
    (a) dormancy
    (b) flowering
    (c) germination
    (d) photosynthesis

23. Gibberellins are known to break dormancy in cereal seeds. This dominantly is due to the secretion of
    (a) protease
    (b) lipase
    (c) alpha amylase
    (d) cellulase
24. Respiratory quotient of carbohydrates with associated organic acid synthesis is (4th NSEB)
(a) 1
(b) > 1
(c) < 1
(d) Either (a) or (b)

25. In an experiment, the carbon dioxide available to a plant labelled with a radioactive isotope and the extent of radioactivity in the chloroplast was measured. As photosynthesis proceeded, in which of the following molecules did the radioactivity first appear?
(a) PGAL (b) PEP (c) PGA (d) RuBP

26. The region where a plant organ is wounded shows (3rd NSEB)
(a) suspension of respiration
(b) no change in the rate of respiration
(c) decrease in the rate of respiration
(d) increase in the rate of respiration

27. The condition under which Daphnia reproduce parthenogenetically is (a) in summer, in condition of abundant food in pond
(b) in winter in lack of abundant food
(c) in reduced oxygen content
(d) in cold temperature

28. Mohl’s half leaf experiment is to prove that (a) chlorophyll is necessary
(b) O₂ is released during photosynthesis
(c) organic substance is produced
(d) CO₂ is necessary for photosynthesis

29. Cross pollination offers certain advantages as well as disadvantages to plants. Which one of the following statements is not true about cross pollination? (1st NSEB)
(c) Cross pollination
(a) can fail to take place due to distance barrier
(b) is less economic because plants have to produce large number of pollen grains
(c) often gives high yields of a crop
(d) takes place only in monoecious flowers

30. When light strikes chlorophyll molecules in a photosynthetically active chloroplast I, they lose electrons. What is the ultimate source of replacement electrons? (a) Water
(b) Carbon dioxide
(c) Glucose
(d) Reduction of NADPH

31. Plants are affected by a number of specific fungal diseases. Which of the following is a correct pair?
(a) Red rot – Sugarcane (3rd NSEB)
(b) Black rust – Potato
(c) Smut – Grape
(d) Late blight – Mustard

32. A fruit dehiscing by both the sutures and derived from monocarpellary ovary with marginal placentation, is (2nd NSEB)
(a) follicle (b) siliqua (c) legume (d) berry

33. Assertion In Tilia and Nicotiana, the secondary vascular tissues form a continuous cylinder. Reason The interfascicular areas in the primary vascular region are very narrow. Which of the following is true regarding these statements?
(a) Both assertion and Reason are true and Reason is the correct explanation of the Assertion
(b) Both Assertion and Reason are true but reason is not a correct explanation of the Assertion
(c) Assertion is true but Reason is false
(d) Assertion is false but Reason is true

34. A typical plant leaf absorbs
(a) green light only
(b) blue and red light
(c) mostly yellow and blue light
(d) mostly green light
(e) essentially all lights but reflects more yellow and blue light

35. The diagram given below is a transverse section of (4th NSEB)
36. Which one of the following structure found in dicot seed will be genetically identical with its maternal plant?
(a) Testa  (b) Radicle  
(c) Plumule  (d) Cotyledon

37. Two groups of bean seeds, dry and germinating, were treated with a high temperature of 50°C. Only the dry seeds were found to endure it. This is mainly because
(a) dry seeds have hard seed coat  
(b) reserve food is more in dry seeds  
(c) hydration makes enzymes more sensitive to temperature  
(d) germinating seeds are tender  

38. Endothecium is responsible for
(a) nourishment of anther  
(b) dehiscence of anther  
(c) formation of pollen grains  
(d) None of the above

39. Under condition of high atmospheric humidity, hardly any calcium (Ca) is transported to developing fruits, this is caused by
(a) calcium only being transported through the xylem and this transport not taking place anymore  
(b) calcium only being transported through the phloem and this transport not taking place anymore  
(c) transpiration stopping and as a result both xylem and phloem transport stopping  
(d) the stomata closing and transport to the fruit stopping

40. Auxins cannot be considered as catalysts as they are
(a) inactivated by light  
(b) activated up in growth process  
(c) proteinaceous in nature only in large concentrations  

41. Which statement best explains why C_4 grasses often do better than C_3 grasses in hot, dry environments?
(a) C_4 grasses open their stomata at night  
(b) C_4 grasses have nearly eliminated photorespiration  
(c) C_4 grasses generate a positive turgor pressure under high temperature  
(d) The rate of cellular respiration is higher for C_3 grass than for a C_4 grass at high temperature

42. Pollen grains that would easily germinate on stigma are found to germinate in vitro, only with 10-200 ppm of boric acid is added. This suggests that
(a) boron accelerates protein synthesis in pollen grain  
(b) boron has an abrasive effect on the exine  
(c) boric acid serves as a solvent for sporopollenin  
(d) pollen wall is boron deficient and high levels of boron occur in the style and stigma

43. The vascular tissues responsible for the movement of sugar in a plant has
(a) cells with thickened walls but are alive  
(b) cells with both thick and thin wall with both living and non-living cells  
(c) cells with thickened lignified walls, which are non-living at maturity  
(d) non-living cells, which have thin walls with open pores

44. Which of the statements related to plant hormones are true?
I. Phototropism in plants is a result of movement of auxin towards light.
II. Auxin acts by elongation of the cell wall.
III. Auxin moves away from light.
IV. Auxin acts by cell differentiation.  
(a) I and II  
(b) II, III and IV  
(c) II and IV  
(d) I and III

45. Prophylaxis is
(a) curing of the viral diseased plants  
(b) improvement of the power of bacterial disease resistance of the plants  
(c) prevention of the plants from being exposed to the agencies responsible for various plant diseases  
(d) All of the above

46. Which of the following can divert the photosynthetic reaction to mere fluorescence of light?  
(a) Changing the wavelength of the incident light  
(b) Increasing the leaf temperature  
(c) Inactivating the electron acceptors  
(d) Increasing the ratio of chlorophyll and accessory pigments
47. Some apple growers manipulate the mineral supply to make their apples appear more red. How can it be done? (3rd NSEB)
   (a) By adding more iron to the soil
   (b) Adding nitrogen deficiency in the soil
   (c) Adding more magnesium to the soil
   (d) Adding iron deficiency in the soil

48. Following observations are made for a plant grown under different conditions:
   I. chlorides and magnesium in soil + light → green plant
   II. chlorides and magnesium in soil + dark → etiolated plant
   III. magnesium + light → green plant
   IV. intermittent light flashes + chlorides → etiolated plant (1st NSEB)

From the above observations, tick mark the factors necessary for the green colour in plants.
   (a) Chlorides and light
   (b) Chlorides, magnesium and light
   (c) Magnesium and light
   (d) Flash of light with chlorides

49. The graph represents an

![Graph](image)

(a) absorption spectrum
(b) action spectrum
(c) interference pattern
(d) spectroscopy (1st NSEB)

50. Match the plant hormones listed in column I with their major role listed in column II and mark your answer from codes given below the list.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
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<tbody>
<tr>
<td>A. Auxin</td>
<td>1. Fruit ripening</td>
</tr>
<tr>
<td>B. Cytokinins</td>
<td>2. Phototropism</td>
</tr>
<tr>
<td>C. Abscisic acid</td>
<td>3. Suppression of cell division</td>
</tr>
<tr>
<td>D. Ethylene</td>
<td>4. Stomatal opening and closing</td>
</tr>
<tr>
<td></td>
<td>5. Growth of lateral buds</td>
</tr>
</tbody>
</table>

51. Both phloem sieve tube cells and xylem vessel cells are derived from the same kind of precursor cell, but at maturity they are very different. What feature is unique to phloem sieve tube cells?
   (a) The cell membrane remains intact in a mature functioning cell
   (b) The nucleus is firmly attached to the cell membrane
   (c) The cell wall is rigid because of the deposition of lignin
   (d) The cell undergoes programmed cell death during development
   (e) The cell contributes to the mechanical support of the stem

52. A plant cell suspended in a test solution shows the following change in morphology. The test solution possibly could be (4th NSEB)

![Cell Diagram](image)

   (a) hypertonic containing sodium chloride
   (b) hypotonic containing sucrose
   (c) water containing glycerol
   (d) Either (b) or (c)

53. The photoreceptor regulating phototropism in higher plants is called
   (a) phytochrome
   (b) blue/UV-A photoreceptor
   (c) cytochrome
   (d) UV-B photoreceptor

54. Crescograph was used to
   (a) investigate sleep movement of bean leaves
   (b) study the role of phytochrome in seed germination
   (c) record the progress of plant growth
   (d) distinguish between short day plants and long day plants
55. An important difference between the zoospores and aplanospores is that
   (a) aplanospores are uninucleate while zoospores are binucleate
   (b) aplanospores are smaller while zoospores are larger
   (c) aplanospores are non-motile while zoospores are motile
   (d) None of the above

56. Three bean seedlings were grown in three culture solutions. After six weeks, X had yellow leaves and short internodes, Y has red patches on the stem and Z had green leaves and stem. It can be deduced that
   (a) X lacked magnesium, Y lacked calcium and Z lacked molybdenum
   (b) X lacked calcium, Y lacked nitrogen and Z lackeded chlorine
   (c) X lacked calcium, Y lacked nitrogen and Z had all nutrients
   (d) X lacked magnesium, Y lacked nitrogen and Z contains all nutrients.

57. **Assertion** A ripe fruit contains less carbohydrate than an unripe fruit.
    **Reason** During the ripening process, the vitamins present in the unripe fruit convert the carbohydrates into sugar.
   (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
   (b) Both Assertion and Reason are true but Reason is not a correct explanation of the Assertion
   (c) Assertion is true but Reason is false
   (d) Assertion is false but Reason is true

58. An investigator wanted to test the mass-flow theory of phloem transport. She knew that a growing melon must receive a large flow of organic material by way of the slender vine. Therefore, she thought if she cut the vine, a good seal of phloem sap should leak out of the stump. But when she tried, only a small droplet of phloem sap emerged from the stump. What is most likely to have happened?
   (a) The mass-flow theory was wrong
   (b) The flow stopped because the melon no longer provided the needed pull
   (c) The flow stopped because without the melon, phloem transport was no longer needed
   (d) The sieve pores probably got plugged with P-protein
   (e) The callose system stopped producing A1 needed for transport

59. As compared to most of the plants, the red algae can thrive at greater depths in water because they
   (a) possess special enzymes for photosynthesis in poor light
   (b) can tolerate very cold medium
   (c) possess supplementary pigments for absorption of light
   (d) have developed tolerance to toxic metabolites

60. Root hairs of a plant are important because they
   (a) connect with xylem tissue in the root for efficient transport of water
   (b) provide a habitat for *Rhizobium* bacteria to fix nitrogen
   (c) help to anchor the plant in the soil
   (d) increase the surface area of the root for water and nutrient absorption
   (e) help to regulate the amount of sugar available to the root for metabolism

61. Which of the following are true about this figure:
   (a) 'A' is the symplastic pathway
   (b) 'B' is blocked at the endodermis
   (c) It is a stem section
   (d) None of the above

62. Which of the followings are true of CAM (Crassulacean Acid Metabolism) photosynthesis?
   (a) It usually occurs in moist climates
   (b) Bundle sheath and mesophyll cells involved
   (c) Malic acid accumulates in the vacuole during the day
   (d) All of the above
63. The multicellular hair-like structure of Salvinia which remains submerged in water are
(a) roots
(b) rhizoids
(c) 

64. Which is an enzyme required for photosynthesis in which of the following plants?
I. C₂ plants
II. C₄ plants
III. CAM plants
(a) I only
(b) II and III only
(c) I, II and III
(d) Neither I, II and III

65. In angiosperms, each pollen grain produces two sperm. What do these sperm do in the fertilization of a flower?
(a) Each one fertilizes a separate egg cell to give rise to two seeds
(b) One fertilizes an egg cell and the other fertilizes a cell that gives rise to the tissue of the fruit
(c) Both fertilizes a single egg cell
(d) One fertilizes an egg cell and the other fertilizes a cell that forms food reserve tissue

66. A plant growing wild in one country was brought to another with the same latitude and at the same height from sea level. Yet the plant remained sterile. The possible causative factor for this sterility is
(a) temperature difference
(b) difference in the length of the day
(c) absence of a specific carrier
(d) humidity difference

67. Which statement about seed germination in a dicotyledon is false?
(a) The radicle elongates first and absorbs water needed for germination
(b) The chemical energy required for seedling growth comes from compounds stored in the cotyledons
(c) The hypocotyl elongates and carries the plumule into the light
(d) The plumule expands and functions in photosynthesis
(e) The shoot apical meristem is formed after germination

68. Which set of terms most accurately describes the pathway taken by a molecule of CO₂ from the atmosphere to the point where it enters the Calvin cycle?
(a) Stomatal aperture, intercellular space, mesophyll cell wall, chloroplast
(b) Stomatal aperture, epidermal cell, mesophyll cell, chloroplast
(c) Stomatal guard cell, intercellular space, mesophyll cell membrane, chloroplast
(e) Epidermal cell, palisade cell, spongy mesophyll cell, chloroplast

69. Which combination of characteristics of a vessel element are most important for water movement in the xylem?
(a) Rigid cell wall, cell dead at maturity, end walls absent
(b) Rigid cell wall, reduction in size of plastids and mitochondria, end walls present
(c) Rigid cell wall, living cell membrane, end walls absent
(d) Flexible cell wall, nucleus anchored to the cell membrane, end walls present
(e) Flexible cell wall, cell dead at maturity, end walls absent

70. Tannins interfere with fungal growth by
(a) inhibiting amoeboid movement
(b) inhibiting spore formation
(c) inhibiting extracellular digestion
(d) inhibiting chemoholotrophy

71. Which of the following applies to the tissue indicated with the arrow?
(a) It may store fats
(b) It provides nutrients for the young seedling
(c) It is an endosperm
(d) All of the above
72. The hairs found on the roots of plants function to
(a) hold the plant in the ground
(b) confer resistance to infection of soil borne pathogens
(c) help limit water uptake, especially in dry conditions
(d) absorb nutrients and water
(e) synthesize chlorophyll precursors for transport to the leaves

73. If you go out into your garden during mid day when the plants are transpiring and some flower-bearing stems to bring indoors, the following will probably happen even if they are placed in water
(a) The pericycle will be damaged, so the flowers will not last long
(b) Air will get pulled into the phloem causing a blockage
(c) The flowers will wilt due to an embolism in the xylem
(d) All of the above

74. The transport of sucrose in plants occurs by pressure flow through the sieve tubes of the phloem from a source (such as leaves where photosynthesis occurs) to a sink (such as a developing fruit where the photosynthetic products are used or stored). Which statement about phloem transport is false?
(a) Sieve tubes in a source leaf have a low hydrostatic pressure
(b) Water and solutes move through the sieve tube along a pressure gradient
(c) Sucrose is actively transported across the cell membrane in sink tissue
(d) Sieve tube hydrostatic pressure is higher during the day than during the night
(e) Sucrose is swept along by the bulk flow of water in the sieve tubes

75. A cell with a thick cell wall and an animal were placed in distilled water. What would you expect to happen if the solute concentration of the animal cell cytoplasm was the same as the fluid in the vacuole of the plant cell?
(a) Both cells would decrease in size and collapse
(b) The animal cell would decrease in size but the plant cell would remain the same
(c) Both cells would remain the same size
(d) The animal cell would increase in size and burst but the plant cell would remain around the same size
(e) The plant cell would increase in size and burst but the animal cell would around the same size

76. Nitrites are useful for increasing the food production. Yet the excess of nitrites we use in the fields mixed with the drinking water results in
(a) killing intestinal bacteria
(b) producing more amino acids in the body
(c) upsetting enzyme production in the body
(d) converting nitrites into nitrites in the stomach which combines with haemoglobin reducing oxygen carrying process, leading to methaemoglobinemia

77. A plant cell was put into a solution of substance A at a concentration of 200 mmol/L. The rate of uptake into the cell was measured as 5 mmol per minute. When the cell was placed in a solution of substance A at a concentration of 400 mmol/L, the rate of uptake was 10 mmol per minute. When the experiment was repeated with substance B, the rate of uptake was 10 mmol per minute at both concentrations of the substance. Which of the following provides the best explanation of the results?
(a) Substance A appears to move into the cell by active transport, and B by diffusion
(b) Substances A and B appear to move into the cell by passive transport
(c) Substances A and B appear to move into the cell by active transport
(d) Substance A appears to move into the cell by diffusion and substance B by active transport

78. Stomata on the surface of a leaf open by
(a) increasing the water potential in the guard cells
(b) increasing the solute concentration in the guard cells
(c) decreasing the strength of the guard cell wall to allow them to stretch open
(d) decreasing the solute concentration in the guard cells
(e) triggering the cytoskeleton of the guard cell to relax
79. Water moves through a plant by
(a) being pumped by active transport from
    a vessel to xylem vessel
(b) being pumped by active transport within
    a tissue
(c) moving along a gradient of water potential
    from low to high
(d) moving along a gradient of water potential
    from high to low
(e) active transport mechanism in both xylem
    and phloem tissues

80. Plant hormone auxin plays a negative role in
    abscission. Thus, the concentration of auxin will
    be high in
    (a) petals
    (b) sepals
    (c) androecium
    (d) gynoecium

81. The non-vascular land plants and the seedless
    vascular plants share one feature which makes
    them particularly dependent on water is
    (a) lack of seeds
    (b) leaves
    (c) flagellated sperm cells
    (d) None of the above

82. Your favourite houseplant’s younger leaves, not
    the older leaves, are yellowing. You recall that the
    cause of plant sickness can be diagnosed by
    which leaves are yellowing. What is the most
    likely cause of your plant’s blight?
    (a) Too much shade
    (b) Lack of nitrogen-fixing *Rhizobium* bacteria
    (c) A deficiency in a mobile mineral nutrient
    (d) A deficiency in a non-mobile mineral nutrient

83. The vascular tissue responsible for the movement
    of sugars in a plant has
    (a) cells with thickened walls but which are alive
    (b) cells with both thick and thin walls with both
        living and non-living cells
    (c) cells with thickened lignified walls which are
        non-living at maturity
    (d) non-living cells which have thin walls with
        open pores

84. A dwarf plant was infected naturally by a fungus.
    The infection resulted in excessive lengthening
    of the stem of the plant. The secretion of the
    fungus most likely contains *(2nd NSEB)*
    (a) auxin
    (b) gibberellin
    (c) cytokinin
    (d) abscisic acid

85. While you are shopping in a florist shop near
    campus, two sales clerks attempt to determine
    whether some cut flowers are monocots or dicots.
    What would you advise them to do as the most
    practical way to make this determination?
    (a) Check the distribution of vascular bundles in
        the roots
    (b) Count the cotyledons in the embryos
    (c) The dicots would have parallel leaf venation
        and the monocots would have network of
        veins
    (d) The dicots would have petals in multiples of
        4-5 and the monocots would have 3

86. A container has two compartments filled with
    pure water and separated by a membrane that is
    permeable to dye molecules. It dye is then added
    to one compartment, dynamic equilibrium will
    have been achieved when
    (a) there is no movement of dye molecules
    (b) all dye molecules are in one compartment
    (c) all dye molecules are moving in the same
        direction
    (d) there are an equal number of dye molecules
        moving in both directions

87. Archesporium of ovule is
    (a) single celled, derived from nucellar epidermis
    (b) single celled, derived from nucellar
        hypodermis
    (c) multicellular, derived from nucellar
        epidermis
    (d) multicellular, derived from nucellar
        hypodermis

88. CAM (Crassulacean Acid metabolism) plants
    have an adapted photosynthetic process that
    primarily allows them to
    (a) survive more efficiently in humid conditions
    (b) repel herbivores by tasting bitter
    (c) survive in arid conditions
    (d) fix carbon dioxide during the day and night
        so as to double photosynthetic activity
    (e) prevent the enzyme Rubisco from being
        denatured
89. Four types of phytoplankton (A, B, C and D) were collected from different depths of the sea.

For each of these types, the photosynthesis was measured, as represented in the given figure. Which type of phytoplankton was collected at the greatest depth?
(a) A  (b) B  
(c) C  (d) D

90. Tissues that form long, tough strands, as in the leaf stalk of celery, are 
(a) epidermis  
(b) collenchyma  
(c) sclerenchyma  
(d) parenchyma

91. A mineral deficiency is likely to affect older leaves more than younger leaves if 
(a) the mineral is a micro nutrient  
(b) the mineral is very mobile within the plant  
(c) the mineral is required for chlorophyll synthesis  
(d) the deficiency persists for a long period of time

92. Assertion Chandramohan and others found that some exudates of the roots of rice inhibit germination of paddy grains.
Reason Allelopathy is a plant-plant interaction which biochemical exudates act inimically towards one another.
Of the statements, mark the correct answer as :
(a) both Assertion and Reason are true and Reason is the correct explanation of Assertion  
(b) both Assertion and Reason are true but Reason is not the correct explanation of Assertion  
(c) Assertion is true but Reason is false  
(d) Assertion is false but Reason is true

93. Transverse section in the given figure depicts anatomy of (2nd NSE P)
(a) mesophytic leaf  (b) xerophytic leaf  
(c) hydrophytic leaf  (d) monocot leaf

94. Which of the following are true about the plant shown in the figure?
(a) Increasing the day length causes these plants to flower  
(b) They are photoperiod insensitive  
(c) They are long-day plants  
(d) The photoperiod threshold is about 14 hours

95. Gametophytic self-incompatibility does not differ from sporophytic self-incompatibility in that 
(a) there is codominance of self incompatibility alleles  
(b) both gives 50% functional pollen in pollinations of some other plants  
(c) there is breakdown of incompatibility on induction of polyploidy  
(d) there is complete failure of seed set on self pollination
96. The sap of a plant cell has an osmotic potential of \(-10\) bar and there is wall pressure of \(2\) bar. When this cell is placed in a solution with an osmotic potential of \(-3\) bar, the force causing water to enter the cell is:
(a) \(-7\) bar 
(b) \(-7\) bar 
(c) \(-3\) bar 
(d) \(-3\) bar

97. If a dark period of a short day plant is interrupted by a flash of light, it will (3rd NSEB)
(a) flower immediately 
(b) produce many flowers 
(c) produce abnormal flowers 
(d) not produce flowers

98. The ratio of osmotic pressure exerted by 1 M sucrose and 1 M NaCl solution will be (1st NSEB)
(a) 1 
(b) 2 
(c) 0.1 
(d) 0.5

99. During the light-dependent reactions of photosynthesis (photophosphorylation), light energy is converted to chemical potential energy through the process of chemiosmosis in the chloroplasts. Which of the following statements about this process is false?
(a) The electron carriers of photophosphorylation are located in the thylakoid membranes of the chloroplasts 
(b) During photophosphorylation, the chloroplast stroma becomes more acidic than the interior of the thylakoid membranes 
(c) Protons diffuse through protein channels which are ATP synthetase molecules 
(d) ATP is synthesized from ADP and P\(_i\) on the stroma side of the thylakoid membranes in the chloroplast 
(e) During photophosphorylation, water ionizes to form H\(^+\) and OH\(^-\) ions, yielding an electron to photosystem II

100. During the malting process, starch stored in the barley grain is broken down to sugars. These sugars provide the energy for anaerobic respiration by yeast cells during the beer making process. Which of the following observations indicates that the plant hormone, gibberellic acid, is required for this process?
(a) The yeast cells respire aerobically if O\(_2\) is bubbled through the brew 
(b) Gibberellic acid promotes stem elongation 
(c) Amylase enzyme converts starch to sugar 
(d) The plant hormone, abscisic acid, prevents barley seed germination 
(e) No alcohol is produced if the embryo is removed from the barley grain

101. In 1925, the Japanese biologist Eiichi Kurosawa showed that the bakanae (foolish seedling) disease of rice was caused by a substance produced by the fungus Gibberella fujikuroi. The substance was named 'gibberellin' and was shown to cause elongation of stem tissues. Which of the following statements about gibberellin is false?
(a) Pea plants carrying the dwarf mutation would be expected to have higher levels of gibberellin in their stems than normal plants 
(b) If gibberellin is applied to the stems of dwarf pea plants, the stems elongate so the plant reach normal height 
(c) Dwarf pea plants have a mutation in the gibberellin biosynthetic pathway 
(d) Normal pea plants respond to gibberellin by growing even taller 
(e) The gibberellin produced by the fungus caused normal healthy rice plants to become unusually tall

102. Which statement about the function of the Caspian strip is correct?
(a) It prevents excess transpiration from leaves 
(b) It regulates ion movement into the root vascular cylinder 
(c) It prevents disease organisms from invading the plant 
(d) It prevents ions from leaking out of the xylem into leaves 
(e) It is the pathway for nutrient transfer from xylem to phloem

103. The function of absorbing water and mineral salts from the soil is performed by (2nd NSEB)
(a) root cap 
(b) actively dividing region of the root cells 
(c) region of elongation 
(d) region of maturation

104. In a gritty fruit like pear, the fleshy part and the spotted wall of the fruit are respectively made up of (4th NSEB)
(a) sclereids and parenchyma 
(b) parenchyma and sclereids 
(c) collenchyma and parenchyma 
(d) sclereids and collenchyma
105. A scientist who worked on a single-celled green plant (an alga) treated it with ultraviolet light and produced mutant cells that did not contain chloroplasts. To keep these cells alive, the scientist had to
(a) provide them with high light intensity
(b) keep them in the dark
(c) provide them with a sugar solution
(d) give them chlorophyll

106. Cotyledons are the first leaves produced by the embryos of vascular plants. Which of the following is not a physiological function of cotyledons?
(a) Absorption of carbohydrates from the endosperm
(b) Photosynthesis
(c) Storage of proteins
(d) Vegetative propagation

107. What path does a carbon atom take in going from the atmosphere into the cell wall of a root cap cell?
(a) Stoma → Proplastid → Chloroplast → Vessel Element → Pro cambium → Apical meristem → root cap
(b) Stoma → Chloroplast → Phloem → Apical meristem → Pro cambium → Root cap
(c) Stoma → chloroplast → Vessel element → Pro cambium → Apical meristem → Root cap
(d) Stoma → Chloroplast → Sieve tube → Pro cambium → Apical meristem → Root cap
(e) All of these paths are possible

108. Which of the following changes would decrease the rate of water loss (transpiration) from the leaves of a sugar maple tree?
(a) Light breeze
(b) Bright sunshine
(c) An afternoon rain shower
(d) A plentiful supply of soil water
(e) High temperature during the afternoon

109. Essential elements of the xylem transport water and nutrients under negative pressure. Which of the following is not a characteristic of vessel elements?
(a) Cells are elongated in shape
(b) Thickened rigid secondary walls are present
(c) The end walls are lysed forming a perforation
(d) Wide-diameter pores are present at the ends of the cell
(e) The nucleus and cytoplasm undergo autolysis

110. Which of the following gives sexual reproduction an advantage over asexual reproduction?
(a) It produces more offspring
(b) It ensures the survival of the species
(c) It increases the variation among the offspring of an individual
(d) It preserves parental genotypes
(e) It allows evolution due to sexual selection

111. Cell division typically occurs only in the meristematic regions of plants. In which region would cell division not occur?
(a) Shoot apex
(b) Wood
(c) Root apex
(d) Cambium between wood and bark
(e) Expanding leaf

112. The main effect of cytokinins in plants is to
(a) increase the length of internodes on flowering stems
(b) prevent the growth of lateral buds
(c) regulate opening and closing of stomata
(d) stimulate cell division
(e) improve the quality of fruits

113. Which of the following structures of a flower are correctly matched with its main function?
(a) Anther—Produces sporocytes
(b) Petal—Attracts pollinators
(c) Ovary—Maintains the orientation of the flower
(d) Sepal—Protects flower from pathogens

114. Which of the following plant hormones is correctly matched with its function?
(a) Abscisic acid—Promotes seed dormancy
(b) Gibberellic acid—Promotes fruit ripening
(c) Auxin—Promotes leaf senescence
(d) Cytokinin—Promotes seed dormancy

115. The content of a large vacuole in a eukaryotic cell has the same osmotic pressure as the surrounding cytoplasm, to prevent it from shrinking or bursting. If this eukaryotic cell is placed in a 3 M sucrose solution
(a) the cell would burst
(b) the vacuole would expand and burst
(c) the cell and the vacuole would both shrink
(d) the cell would shrink but the vacuole would remain the same size
(e) nothing would happen, because a 3 M sucrose solution has the same osmotic pressure as the cell cytoplasm
Exercise II

1. Leaves appear green because they reflect green colour from light spectrum. The part in the leaf that is actually responsible for this reflection is
   (a) inner membrane of chloroplast
   (b) thylakoid space
   (c) thylakoid membrane
   (d) stroma

2. Wall of ovary of flowering plants gets converted as a result of fertilization. The type of ovary wall shown facilitates
   (2nd INBO)
   (a) wind dispersal
   (b) animal dispersal
   (c) water dispersal
   (d) mechanical dispersal

3. A branch is cut off very close to the trunk and the wound heals fast. In another tree, a cut is made leaving a stump projecting some distance beyond the trunk, delaying the healing. This is because of the distance of the cut from the
   (a) vascular cambium
   (b) cork cambium
   (c) apical meristem
   (d) interfascicular cambium

4. Pericycle of roots is the site of origin of
   (a) lateral roots
   (b) secondary meristems
   (c) cork cambium
   (d) All of these

5. If you keep a C₃ plant and a C₄ plant of comparable size in an air-tight glass container and provide them with adequate sunlight, you would expect the C₄ plant to
   (a) grow better than the C₃ plant after one year in that condition
   (b) grow slower than the C₃ plant after one year in that condition
   (c) be able to survive longer than the C₃ plant, but ultimately die
   (d) be able to survive not as long as the C₃ plant

6. In shade loving plants, their “Light Compensation Point” is reached at low irradiance because
   (2nd INBO)
   (a) leaves have more chlorophyll per reaction centre
   (b) these plants have greatly reduced respiration rates
   (c) shade plant is capable of much lower rates of photosynthesis than the Sun plants
   (d) shade loving plants synthesize pigments such as anthocyanins to promote photosynthesis

7. To test the hypothesis that germinating seeds of different species might influence one another, a biologist planted seeds of species I and species II in the same tray. Upon germination it was found that species I seeds sprouted faster than species II seeds.

In order for the results to be interpreted properly, the biologist should also germinate:
   (a) I and II seeds in the dark
   (b) I and II seeds at various temperatures
   (c) the same number of I and II seeds
   (d) I and II seeds in separate trays

8. A C₃ plant was grown at different temperatures: one below 28°C and one above 28°C. In which of the plants, the carbon loss due to photorespiration is more
   (a) Plant below 28°C
   (b) Plant above 28°C
   (c) Same for both
   (d) None of the above

9. Of the various biological processes listed below, the most ancient one is
   (2nd INBO)
   (a) photosynthesis
   (b) mitosis
   (c) meiosis
   (d) fermentation

10. When sunlight is on the chloroplast, pH is lowest in the
    (a) stroma
    (b) cytosol
    (c) space enclosed by the thylakoid membranes
    (d) space enclosed by the inner and outer membranes

11. In an experimental set-up, a group of C₃ and a group of C₄ plants were grown in an environment with double the amount of CO₂ concentration. Which group of plants would grow better and be more water efficient?
    (a) C₃ plants will be better than C₄ plants
    (b) C₄ plants will be better than C₃ plants
    (c) Both C₃ and C₄ plants will show equal growth
    (d) None of the above
12. The diagram illustrates stomatal closing. The major mistake in the diagram is **(4th, NSEB)**

(a) the concentration of the $K^+$ should be more outside the guard cells  
(b) the concentration of the $K^+$ should be equal on both inside and outside  
(c) the peripheral walls of the guard cells should be thicker  
(d) the water should move inside the guard cells  

13. Three cylinders, each closed by a membrane permeable to water and containing a different fluid, are placed in the same solution. After adjusting to the solution, the fluid rises in one of the cylinders, remains the same in another, and falls in the third. The concentration of the solution in which the cylinders have been placed is

(a) 0% salt solution (distilled water)  
(b) 2.5% salt solution  
(c) 5.0% salt solution  
(d) 10.0% salt solution  

14. Which of the plots A, B, C or D in the graph shows the effect of light intensity on the rate of photosynthesis?

15. The graphs below show the relationship between the rate of water loss by transpiration and leaf temperature. Based on these results, which plant is best adapted for conserving water in a hot dry environment?

(a) Sunflower  
(b) Maple  
(c) Creosote  
(d) Grass  
(e) Pine

16. Which of the following would be the least productive in trying to work out the relationship between annual plants discovered in a large population which looked similar but which could be divided into two different size classes?

(a) Measurement of photosynthetic capacity of plants from each size class and comparing such  
(b) Sequencing of genes from a plant representative of each size class  
(c) Recording the growth rates, distribution and reproductive strategies of plants from each size class  
(d) Growing seed from plants belonging to each size class under identical conditions  
(e) Growing seed from plants belonging to one size class in different conditions

17. Given that the critical day length of a long-day plant is 16.0 hours, flashes of red and/or far-red light were given at specific intervals. The figure below indicate different exposures of light given
20. In which region of the trunk, would you expect to find the oldest cells?
   (a) Region A  (b) Region B  (c) Region C  (d) Region D  (e) Region E

21. In which region of the trunk, would you expect to first find radioactivity if the plant was exposed to carbon-14 labelled (radioactive) carbon dioxide?
   (a) Region A  (b) Region B  (c) Region C  (d) Region D  (e) Region E

22. In these figures, two life-cycles are described. Mark the correct option.

   ![Diagram of life cycle]

   (a) Fertilization
   (b) Gamete
   (c) Gamete
   (d) Meiosis
   (e) 2n Zygote
   (f) 2n Zygote

23. Having one cotyledon distinguishes monocot seeds from dicot seeds. What other feature is to monocots?
   (a) The nutrients required for germination are stored in the endosperm
   (b) The shoot apical meristem is present at the time of germination
   (c) The embryonic root is the first organ to penetrate the seed coat
   (d) The root apical meristem is protected by a root cap
   (e) The embryo is surrounded by a protective seed coat

18. How many years old is the twig shown in the following figure?
   (a) One  (b) Two  (c) Three  (d) Five

19. Which of the following are effective at reducing transpiration loss?
   I. Sunken stomata
   II. Leaf hairs
   III. Large flat leaf
   IV. Parallel venation
   (a) I and II  (b) I, II and IV  (c) II, III and IV  (d) I, II, III and IV

Questions 20 and 21 relate to the following diagram representing the cross section of a tree trunk.
24. The graph shows the relation between influence of light intensity and CO₂ concentration on the rate of photosynthesis of *Chlorella*.
Which one of the following statements explains the diagram correctly?

(a) At low light intensity, the light-dependent reaction is rate limiting but at high light intensity, CO₂ is rate limiting
(b) The number of chlorophyll molecules limits the rate of photosynthesis
(c) Photosynthesis is independent of light intensity provided there is no total darkness
(d) Chlorophyll responds equally to light intensities and CO₂ concentrations, thereby limiting the rate of photosynthesis

25. Figure represents the set-up for a water culture tube to be used in determining the effect of mineral deficiencies on plant growth. The purpose of the aluminium foil is to

(a) prevent the growth of algae
(b) prevent photosynthesis by the seedling
(c) keep the solution warm
(d) keep the tube upright

26. Which instrument is used in the given experimental set-up and what does it demonstrate?

(a) A photometer demonstrating transpiration rate of a plant
(b) Clinostat demonstrating the elimination of the effect of force gravity
(c) Clinostat demonstrating the upward growth of shoot and downward growth of root
(d) A photometer demonstrating phototropism

27. Transverse section of two year woody stem shown below. Numbers 1 and 2 indicate the annual growth rings A and B in the diagram respectively are

(a) A–Primary xylem
   B–Primary phloem
(b) A–Secondary xylem
   B–Secondary phloem
(c) A–Primary xylem
   B–Cork cambium
(d) A–Pith
   B–Secondary xylem

28. The correct process of phytochrome conversion is

(a) Pr → Pfr
(b) Pr → Pfr
(c) Pfr → Pr
(d) Pr → Pfr

(4th NSEP)
29. Which of the following conditions would yield the highest rate of photosynthesis (as measured by the release of O₂)?

<table>
<thead>
<tr>
<th>Light intensity (light intensity)</th>
<th>Range of wavelength (light quality)</th>
<th>Concentration of atmosphere CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 2000 μmol m⁻²s⁻¹</td>
<td>400 to 700 nm</td>
<td>330 ppm</td>
</tr>
<tr>
<td>(b) 2000 μmol m⁻²s⁻¹</td>
<td>100 to 400 nm</td>
<td>350 ppm</td>
</tr>
<tr>
<td>(c) 2000 μmol m⁻²s⁻¹</td>
<td>100 to 400 nm</td>
<td>250 ppm</td>
</tr>
<tr>
<td>(d) 1000 μmol m⁻²s⁻¹</td>
<td>500 to 600 nm</td>
<td>100 ppm</td>
</tr>
<tr>
<td>(e) 1000 μmol m⁻²s⁻¹</td>
<td>400 to 700 nm</td>
<td>100 ppm</td>
</tr>
</tbody>
</table>

30. Given are two transverse sections. Observe the figures carefully and mark the correct option. (2nd INBO)

(a) Fig. A and B represent stem and leaf anatomy respectively
(b) Fig. A is a leaf of C₄ plant and fig. B is leaf of C₃ plant
(c) Fig. A represents xerophyte stem and fig. B a mesophyte stem
(d) Both figures represent leaves of C₃ plants

31. In an experiment, seeds of a plant species were allowed to germinate under two different conditions
I. Seeds were exposed to visible light.
II. Seeds were covered with blue filter.
Plants that emerged in both sets were green. The correct interpretation of the experiment is
(a) blue light is essential for chlorophyll synthesis
(b) plants can synthesize chlorophyll in absence of blue light
(c) blue light alone can promote chlorophyll synthesis
(d) red and yellow light have no effect on synthesis of chlorophyll

32. The living and non-lignified component of vascular bundle is / are
(a) vessel and tracheid
(b) vessel and phloem
(c) wood fibres and phloem
(d) wood parenchyma and phloem

33. Which of the following labels in the given figure of a leaf cross-section is not correct?

(a) epidermal cell-A
(b) palisade mesophyll cell-B
(c) intercellular air space-C
(d) spongy mesophyll cell-D
(e) xylem cell-E

34. Which of the following trends mark the transition of plants from water to land?
I. Development of secondary cell wall.
II. Decrease in surface area as a result of increase in volume.
III. Increase in the dependence of haploid stages on diploid stages.
IV. Progressive shortening of haploid stage.
(a) I and III
(b) II and IV
(c) I, III and IV
(d) I and IV

35. If a plant cell has its cell wall removed and is placed in a hypotonic solution, what will happen to the cell?
(a) The cell will already be dead because plant cells cannot survive without a cell wall
(b) The cell will expand and eventually burst
(c) The cell will shrink because the vacuole gets smaller
(d) Nothing obvious would happen
(e) The nucleus will burst, but the cell will stay

36. Reproduction is often connected with a shift from haploid to diploid or vice versa. Please read the diagram and decide which group of organisms shows the type of shift mentioned.

(a) Humans
(b) Angiospermic plants
(c) Gymnospermic plants
(d) Ferns

37. Of the figures A, B, C, and D, the stomatal apparatus that belong to jowar is (2nd NSEP)

(a) A  (b) B
(c) C  (d) D

38. Flowers pollinated by bees show certain structures that complement with aspects of the physiology of bees. These structures are:
(a) Mostly blue or yellow flower petals
(b) Odourless flowers
(c) Superficial location of nectar glands
(d) Nocturnal opening of flowers

39. The graph indicates action spectrum of phototropism. The dashed line in the graph indicates an absorption spectrum of (2nd NSEP)

(a) Cotyledon
(b) Hypocotyl
(c) Seed coat
(d) Meristem
(e) Plumule

40. The graph reveals stomatal opening in relation to environmental factors. It is maximum at (4th NSEP)

(a) Riboflavin
(b) Carotene
(c) Chlorophyll
(d) Anthocyanin

41. Which label on the diagram of a peanut (shown in figure) is not correct?

(a) Cotyledon
(b) Hypocotyl
(c) Seed coat
(d) Meristem
(e) Plumule
42. Transport of the products of photosynthesis is thought to occur by pressure flow through the sieve tubes of the phloem from a source (such as the leaves where the products are produced) to a sink (a developing fruit where fruit are stored). Which of the following statements about phloem transport is false?

(a) Water enters the sieve tubes by osmosis
(b) Sieve tubes in a source have a low hydrostatic pressure
(c) Water and solutes move through the sieve tubes along a pressure gradient
(d) Solute is actively removed from the sieve tubes in the sink area
(e) Solute is swept along by the bulk flow of water in the sieve tubes

43. Deep-water rice is an important crop in south-east Asia where water levels during the rainy season may rise by several metres within a short time. Deep-water rice has the ability to adapt to the rising water by growing quickly, thus keeping its 'head' (flower stalk and upper leaves) above water. Examine the four graphs and identify hormone(s) that regulate(s) this rapid growth.

44. Plant cells can often grow larger than animal cells because

(a) photosynthesis produces more energy than does respiration
(b) plant cells need less food than animal cells
(c) plants use their energy for growth while animals spend much of their energy on movement
(d) plant cells have a cell wall which makes their surface to volume ratio very large
(e) the large central vacuole of plant cells reduces the depth of the cytoplasm and allows entering molecules to rapidly diffuse from the plasma membrane to all parts of the cytoplasm

45. Which of the following cell types provide mechanical support for plants?

(a) Tracheids, sclerenchyma fibres, collenchyma
(b) Sclerenchyma fibres, cork, cortex
(c) Sieve tubes, vessel elements, epidermis
(d) Sclerenchyma fibres, pith cells, epithelial cells
(e) Pith, cortex, xylem
46. Under conditions of a high atmospheric humidity hardly any calcium (Ca) is transported developing fruits. This is caused by
(a) calcium only being transported through the xylem and this transport not taking place anymore
(b) calcium only being transported through the phloem and this transport not taking place anymore
(c) transpiration stopping and, as a result both xylem and phloem transport stopping
(d) the stomata closing and transport to the fruit stopping

47. Identify the indicated structure in the following diagram of a cross section of a tree trunk.

![Tree trunk diagram]

(a) A-Secondary phloem, B-Vascular cambium, C-Secondary xylem, D-Periderm
(b) A-Secondary xylem, B-Cambium, C-Secondary phloem, D-Protoderm
(c) A-Secondary phloem, B-Periderm, C-Secondary xylem, D-Cambium
(d) Vascular cambium, B-Secondary phloem, C-Secondary xylem, D-Periderm

49. Which of the following statements about the Calvin cycle are false?
(a) The first stable product of the cycle is 3-phosphoglycerate
(b) The reducing power of NADPH is used to reduce 3-phosphoglycerate to glyceraldehyde 3-phosphate (PGAL)
(c) The carboxylation of the 5-carbon sugar ribulose 1, 5 bisphosphate (RuBP) is catalysed by the rubisco enzyme (rubulose bisphosphate carboxylase / oxygenase)
(d) Light is not required for the operation of the Calvin cycle
(e) Two molecules of ATP are synthesized for each turn of the cycle

50. Typically, plant species are adapted for photosynthesis in a specific temperature range. Examine the graph that shows the relationships between photosynthetic rate and temperature for the following species: alpine tussock grass (C4 species); wheat from the temperate zone (C3); maize from the subtropics (C4). Which statement about these relationships is false?
(a) Wheat is the species that has the highest rate of photosynthesis when temperatures are around 25°C.
(b) Maize shows maximum photosynthetic rate at 32°C.
(c) C3 species would have higher photosynthetic rates than C4 species.
(d) C3 species would have higher photosynthetic rates than C4 species.
(e) In the Arctic, where mean daily temperatures might be as low as 0°C, the C3 species would have the highest rate of photosynthesis.

51. Charles Darwin and his son, Francis, experimented with phototropism of grass seedlings by placing a metal foil blindfold over different parts of the seedling's coleoptile. A simplified version of their results is shown below. Which of the following statements best explains their result?

53. Using the four graphs below and your knowledge of the action spectrum of photosynthesis and the absorption spectrum of chlorophyll-a and chlorophyll-b, identify the plant pigments responsible for phototropism.
54. Compared to C₃ plants, C₄ plants
(a) remove oxygen from the air spaces between cells in the leaves and thereby avoid photorespiration
(b) fix carbon dioxide into a four carbon sugar at night, and then release the carbon dioxide during the day
(c) concentrate oxygen in cells, thereby overcoming the problem of photorespiration
(d) have enlarged veins to conduct water more efficiently for higher rates of photosynthesis
(e) have adaptations which concentrate carbon dioxide in the photosynthetic cells

55. Most of the water lost by the plant through transpiration exits through the stomatal pores. Which of the following statements about transpiration and stomatal functioning is false?
(a) Stomata normally open in response to a shift from dark to light conditions
(b) When the turgor pressure of guard cells increases, the stomatal aperture opens
(c) With the shift from dark to light, the osmotic potential becomes less negative, resulting in stomatal closure
(d) The turgor pressure of guard cells increases after the osmotic potential becomes more negative
(e) ATP-activated proton pumping system in an influx of K⁺ ions into the guard cells

56. Which factor would contribute the most to increasing the rate of water movement upward in the xylem?
(a) Generation of root pressure
(b) Availability of soil water
(c) Rate of transpiration from the leaves
(d) Rate of carbohydrate loading
(e) Rate of auxin synthesis

germination. The graph shows changes in hormone concentrations (left axis) and hypocotyl growth (right axis) over time for moong bean. Which hormone(s) most likely regulates hypocotyl (bean sprout) growth during moong bean germination?

(a) Gibberellin acid alone
(b) Auxin alone
(c) Abscisic acid alone
(d) Both (a) and (b)
(e) Both (b) and (c)

58. Which of the following graphs most directly depicts the evolution of various vascular plant species in an evolutionary time scale?
59. Photosynthetic features of four plants P, Q, R, and S are depicted in the graphs below.

These plant species belong to
(a) P: C₃ plant  Q: C₄ plant  R: CAM plant  S: Shade plant
(b) P: C₄ plant  Q: C₃ plant  R: C₄ plant  S: C₃ plant
(c) P: C₄ plant  Q: Sun plant  R: C₃ plant  S: CAM plant
(d) P: C₃ plant  Q: C₄ plant  R: C₃ plant  S: C₄ plant

60. The nutritional pathway shown below represents

\[
\text{Chlorophyll} \rightarrow \text{Energy} \rightarrow \text{Succinate} \rightarrow \text{ATP} \rightarrow \text{Fumarate} \rightarrow \text{H} \rightarrow (\text{CH}_2\text{O})_n
\]

(a) photo-litho-autotroph
(b) photo-chemo-heterotroph
(c) photo-organo-autotroph
(d) chemo-organo autotroph

61. On a warm summer’s day, the transpiration pull is the main force that drives water from root parenchyma into the root xylem. The table shows values of \( \psi_p \) (pressure potential) and \( \psi_s \) (solute potential root xylem and root parenchyma, in kPa. In which of the alternatives (a–d) would transpiration pull cause water to move form root parenchyma into the root xylem?

<table>
<thead>
<tr>
<th>Root parenchyma</th>
<th>Root xylem</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \psi_p )</td>
<td>( \psi_s )</td>
</tr>
<tr>
<td>(a) 200</td>
<td>-190</td>
</tr>
<tr>
<td>(b) -200</td>
<td>220</td>
</tr>
<tr>
<td>(c) 200</td>
<td>-220</td>
</tr>
<tr>
<td>(d) 200</td>
<td>-220</td>
</tr>
</tbody>
</table>

62. Calvin and colleagues determined the pathway of carbohydrate synthesis in plants by studying the incorporation of radioactive carbon dioxide into biological compounds. Suppose that photosynthesis is proceeding at a steady pace in a typical experiment with the lights on, and carbon dioxide is being combined with ribulose-bisphosphate (RuBP) to produce 3-phosphoglycerate (3PG). Then suddenly the source of carbon dioxide is eliminated. What changes in the concentrations of 3PG and RuBP would occur?
(a) 3PG levels rise, RuBP levels fall
(b) 3PG levels fall, RuBP levels rise
(c) 3PG levels rise, RuBP levels rise
(d) 3PG levels rise, RuBP levels stay the same

63. Thermal imaging is a technique used to detect mutant varieties of plants that overproduce abscisic acid (ABA). Such plants are warmer than the surrounding plants. This can be explained as
(a) an elevated level of ABA increases the rate of metabolism thereby producing more heat
(b) overproduction of ABA is mostly observed in C₄ plants which require high optimum temperatures for photosynthesis
(c) increased levels of ABA in the cell sap will increase the rate of transpiration causing drying of the plant. This, in turn, will cause such a plant to be warmer than the surrounding plants
(d) increased ABA will not allow the stomata to open completely and thereby reduce evaporative cooling of the plant
64. While working on the root cap of *Rorippa amphibia*, some anatomists noticed presence of a few specialized cells with watery cytoplasm having freely movable starch grains. On further investigation, similar cells were found in the root cap of several other plants. The most likely function of these cells is
(a) to give mechanical strength to the root cap
(b) to provide ready source of energy required for rapid cell divisions at the root tip
(c) to exert pressure along the physically lower side of the cell to ensure positive geotropism
(d) to help replacing the worn out cells of the root cap

65. Auxin at an appropriate concentration can induce cell elongation in certain plant organs. However, tissues respond differently to different concentrations of auxin. Which graph best represents the IAA response of shoot and root?

(a) % elongation

(b) [IAA]

(c) % elongation

(d) [IAA]

66. A few characteristics of C₃ and C₄ plants are compared in the following table. Place >, <, or = in the empty place in the table given below.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type of plant</th>
<th>Type of plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Light compensation point</td>
<td>C₃ plants</td>
<td>C₄ plants</td>
</tr>
<tr>
<td>Photorespiration rate</td>
<td>C₃ plants</td>
<td>C₄ plants</td>
</tr>
<tr>
<td>Optimum temperature for photosynthesis</td>
<td>C₃ plants</td>
<td>C₄ plants</td>
</tr>
<tr>
<td>Productivity</td>
<td>C₃ plants</td>
<td>C₄ plants</td>
</tr>
</tbody>
</table>

67. The figure shows a transverse section of a *Pinus* tree. Correlate the structures with the numbers. Choose from the options given below and fill in your answers in the answer sheet.

Options:
Cambium, Spring wood, Autumn wood, Aerenchyma, Muclage duct, Cuticle, Phloem, Primary ray, Fitch, Periderm
(a). . . . . .
(b). . . . . .
(c). . . . . .
(d). . . . . .

68. Some orders under *Phyophyta* are characterized by homospory *i.e.*, production of only one type of spores that grow in independent, bisexual gametophyte while other are known to exhibit heterospory *i.e.*, production of male/microspores and female/megaspor
developing into male and female gametophytes respectively, often dependent on sporophyte.
Indicate whether the following statements are false by putting a tick mark (✓) in the
rate boxes in the table given in the sheet.

I. Homosporous is an advanced feature involving
development of an independent bisexual
gametophyte.

II. Heterosporous is a primitive feature since a
greater amount of energy is spent for
reproduction.

III. Euterosporous is a transitional evolutionary
stage in the evolution of spermatophytes since

it involves retention of spores and
gametophytes in the sporangia.

IV. Homosporous is a primitive feature since it
involves development of an independent
gametophyte that has to complete vegetative
growth before taking up reproduction.

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Answers

Exercise 1

1. (b) 2. (c) 3. (b) 4. (b) 5. (a) 6. (c) 7. (a) 8. (c)
9. (a) 10. (c) 11. (c) 12. (c) 13. (b) 14. (a) 15. (b) 16. (b)
17. (c) 18. (b) 19. (a) 20. (b) 21. (d) 22. (c) 23. (c) 24. (c)
25. (c) 26. (d) 27. (a) 28. (d) 29. (d) 30. (d) 31. (a) 32. (c)
33. (a) 34. (b) 35. (a) 36. (a) 37. (c) 38. (b) 39. (a) 40. (b)
41. (d) 42. (d) 43. (c) 44. (b) 45. (c) 46. (c) 47. (b) 48. (c)
49. (b) 50. (c) 51. (a) 52. (d) 53. (b) 54. (c) 55. (c) 56. (d)
57. (a) 58. (d) 59. (c) 60. (e) 61. (d) 62. (b) 63. (c) 64. (a)
65. (d) 66. (c) 67. (e) 68. (a) 69. (a) 70. (c) 71. (d) 72. (d)
73. (c) 74. (a) 75. (d) 76. (d) 77. (d) 78. (b) 79. (a) 80. (d)
81. (c) 82. (d) 83. (c) 84. (b) 85. (d) 86. (d) 87. (b) 88. (c)
89. (a) 90. (c) 91. (b) 92. (b) 93. (b) 94. (d) 95. (d) 96. (c)
97. (d) 98. (d) 99. (b) 100. (c) 101. (a) 102. (a) 103. (d) 104. (b)
105. (c) 106. (d) 107. (d) 108. (c) 109. (d) 110. (c) 111. (b) 112. (d)
113. (b) 114. (a) 115. (c)

Exercise 2

1. (c) 2. (c) 3. (b) 4. (d) 5. (b) 6. (a) 7. (d) 8. (b)
9. (d) 10. (c) 11. (b) 12. (a) 13. (c) 14. (c) 15. (c) 16. (e)
17. (b) 18. (d) 19. (a) 20. (e) 21. (d) 22. (a) 23. (a) 24. (d)
25. (a) 26. (b) 27. (a) 28. (a) 29. (a) 30. (d) 31. (c) 32. (d)
33. (d) 34. (c) 35. (b) 36. (d) 37. (d) 38. (a) 39. (b) 40. (d)
41. (a) 42. (b) 43. (c) 44. (e) 45. (a) 46. (a) 47. (a) 48. (c)
49. (e) 50. (a) 51. (d) 52. (b) 53. (d) 54. (e) 55. (c) 56. (c)
57. (d) 58. (a) 59. (b) 60. (c) 61. (d) 62. (b) 63. (d) 64. (c)
65. (a)
### Explanations

<table>
<thead>
<tr>
<th>Characteristic</th>
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<th>$&gt;/\leq/&lt;$</th>
<th>Type of plant</th>
</tr>
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<tr>
<td>Light compensation point</td>
<td>$C_3$ plants</td>
<td>$&gt;$</td>
<td>$C_4$ plants</td>
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<td>$C_3$ plants</td>
<td>$&lt;$</td>
<td>$C_4$ plants</td>
</tr>
<tr>
<td>Productivity</td>
<td>$C_3$ plants</td>
<td>$&lt;$</td>
<td>$C_4$ plants</td>
</tr>
</tbody>
</table>

67. 1. Mucilage duct  
2. Cambium  
3. Spring wood  
4. Autumn wood

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td>I</td>
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</tr>
<tr>
<td>III</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>✓</td>
<td></td>
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</table>