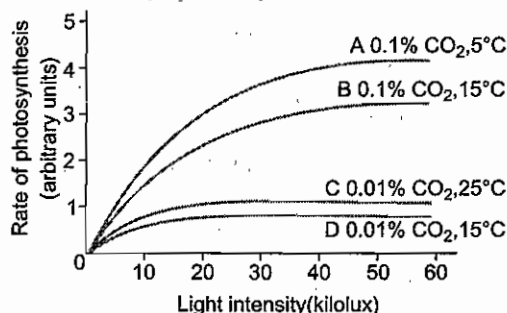


Let us Practice

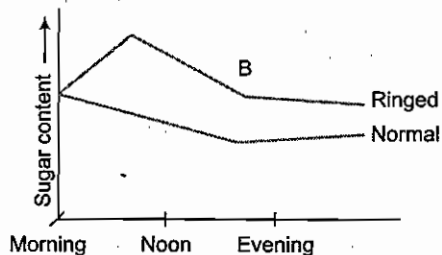
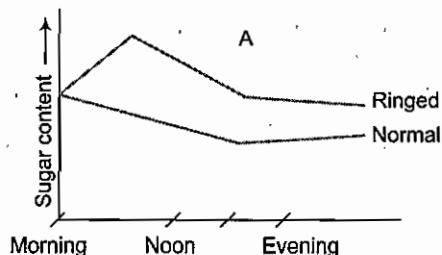
Exercise I

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

Increase in light intensity



- (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

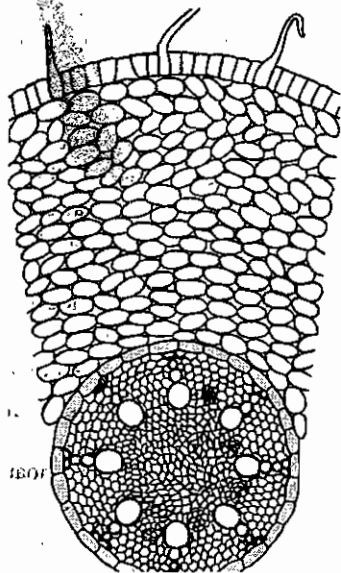


ground. When sugar content of the phloem tissue above and below the ring was compared with another normal (non-ringed) plant, given two graphs were obtained. Mark the correct interpretation (2nd NSEB)

- (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? (3rd NSEB)
 (a) Root
 (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 (1st NSEB)
 (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 (3rd NSEB)
 (c) sap wood (d) hard wood
10. In the stellar evolution, the type of stele that is highly evolved is (2nd NSEB)
 (a) dictyostele (b) haplostele
 (c) solanostele (d) atactostele
11. The major function of sieve tubes in plants, is (1st NSEB)
 (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 *Borassus* palm on an island and no male palms. There are a few male *Borassus* 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. $2NH_3 + 3O_3 \rightarrow 2NHO_2 + 2H_2O + \text{energy}$
 This reaction nitrifying bacteria indicates that they are (1st NSEB)
 (a) photoautotrophic (b) chemoautotrophic
 (c) photoheterotrophic (d) chemoheterotrophic
17. The mineral element in chlorophyll and haemoglobin is respectively (2nd NSEB)
 (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 from one 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 is prevented by formation of callose plugs at intervals.
 (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 (4th NSEB)
 (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 is characteristically (2nd NSEB)
 (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 (1st NSEB)
 (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 (4th NSEB)
 (a) dormancy (b) flowering
 (c) germination (d) photosynthesis
23. Gibberellins are known to break dormancy of cereal seeds. This is due to the secretion of (1st NSEB)
 (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 was labelled with a radioactive isotope and the amount 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)
 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) silique
 (c) legume (d) berry
33. **Assertion** In *Tilia* and *Nicotina*, 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)



- (a) monocot root (b) monocot stem
(c) dicot root (d) dicot stem
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 (3rd NSEB)
(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 (3rd NSEB)
(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 (1st NSEB)
(a) inactivated by light
(b) tied up in growth process
(c) non-proteinaceous in nature
(d) active only in large concentrations
41. Which statement best explains why C₄ grasses often do better than C₃ grasses in hot, dry environments?
(a) C₄ grasses open their stomata at night
(b) C₄ grasses have nearly eliminated photorespiration
(c) C₄ grasses generate a positive turgor pressure under high temperature
(d) The rate of cellular respiration is higher for C₃ grass than for a C₄ grass at high temperature
42. Pollen grains that would easily germinate on stigma are found to germinate *in vitro*, only when 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 sporopollenins
(d) pollen wall is boron deficient and high level 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 wall 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 hormone auxin 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. (4th NSEB)
(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? (4th NSEB)
(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
 reating nitrogen deficiency in the soil
 adding more magnesium to the soil
 reating 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

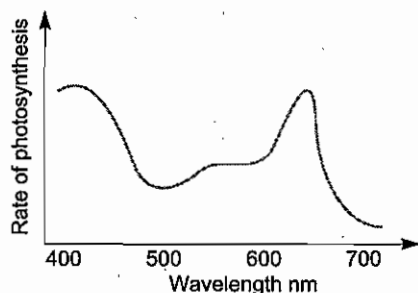
III. magnesium + light → green plant

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



(1st NSEB)

- (a) absorption spectrum
 (b) action spectrum
 (c) interference pattern
 (d) spectroscopy

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.

Column I	Column II
A. Auxin	1. Fruit ripening
B. Cytokinins	2. Phototropism
C. Abscissic acid	3. Suppression of cell division
D. Ethylene	4. Stomatal opening and closing
	5. Growth of lateral buds

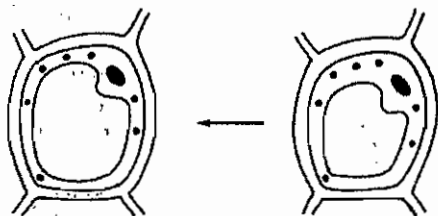
Codes:

A	B	C	D	A	B	C	D
(a) 5	3	4	2	(b) 3	2	4	1
(c) 2	5	4	3	(d) 2	4	5	1

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)



- (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
- aplanospores are uninucleate while zoospores are binucleate
 - aplanospores are smaller while zoospores are larger
 - aplanospores are non-motile while zoospores are motile
 - 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

- X lacked magnesium, Y lacked calcium and Z lacked molybdenum
- X lacked calcium, Y lacked nitrogen and Z lacked chlorine
- X lacked calcium, Y lacked nitrogen and Z had all nutrients
- 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.

- Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
- Both Assertion and Reason are true but Reason is not a correct explanation of the Assertion
- Assertion is true but Reason is false
- 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. herefore, she thought if she cut the vine, a good deal of phloem sap should leak out of the stump. ut when she tried, only a small droplet of phloem sap emerged from the stump. What is most likely to have happened?

- The mass-flow theory was wrong
- The flow stopped because the melon no longer provided the needed pull
- The flow stopped because without the melon, phloem transport was no longer needed

- The sieve pores probably got plugged with P-protein
- The callose system stopped producing ATP needed for transport

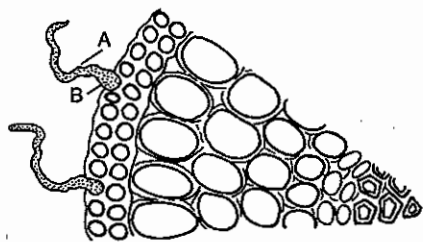
59. As compared to most of the plants, the red algae can thrive at greater depths in water because they

- possess special enzymes for photosynthesis in poor light
- can tolerate very cold medium
- possess supplementary pigments for absorption of light
- have developed tolerance to toxic metabolites

60. Root hairs of a plant are important because they

- connect with xylem tissue in the root for the efficient transport of water
- provide a habitat for *Rhizobium* bacteria to live and fix nitrogen
- help to anchor the plant in the soil
- increase the surface area of the root for water and nutrient absorption
- help to regulate the amount of sugar available to the root for metabolism

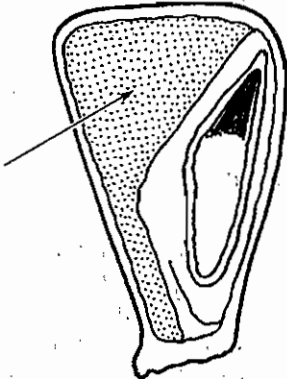
61. Which of the following are true about this figure?



- 'A' is the symplastic pathway
- 'B' is blocked at the endodermis
- It is a stem section
- None of the above

62. Which of the followings are true of CAM (Crassulacean Acid Metabolism) photosynthesis?

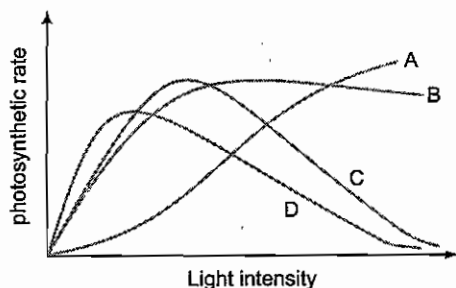
- It usually occurs in moist climates
- Bundle sheath and mesophyll cells are involved
- Malic acid accumulates in the vacuole during the day
- All of the above

63. The multicellular hair-like structure of *Salvinia* which remains submerged in water are
 (a) roots
 (b) rhizoids
 (c)
 (c)
64. RuBisCo is an enzyme required for photosynthesis in which of the following plants?
 I. C_3 plants
 II. C_4 plants
 III. CAM plants
 (a) I only
 (b) II and II 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 (1st NSEB)
 (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 CO_2 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 chemoautotrophy
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
- hold the plant in the ground
 - confer resistance to infection of soil borne pathogens
 - help limit water uptake, especially in dry conditions
 - absorb nutrients and water
 - 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
- The pericycle will be damaged, so the flowers will not last long
 - Air will get pulled into the phloem causing a blockage
 - The flowers will wilt due to an embolism in the xylem
 - 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?
- Sieve tubes in a source leaf have a low hydrostatic pressure
 - Water and solutes move through the sieve tube along a pressure gradient
 - Sucrose is actively transported across the cell membrane in sink tissue
 - Sieve tube hydrostatic pressure is higher during the day than during the night
 - Sucrose is swept along by the bulk flow of water in the sieve tubes
75. A plant cell with a thick cell wall and an animal cell are 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?
- Both cells would decrease in size and collapse
 - The animal cell would decrease in size but the plant cell would remain the same
 - Both cells would remain the same size
 - The animal cell would increase in size and burst but the plant cell would remain around the same size
 - The plant cell would increase in size and burst but the animal cell would remain around the same size
76. Nitrates are useful for increasing the food production. Yet the excess of nitrates we use in the fields mixed with the drinking water results in
- killing intestinal bacteria
 - producing more amino acids in the body
 - upsetting enzyme production in the body
 - converting nitrates 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/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?
- Substance A appears to move into the cell by active transport, and B by diffusion
 - Substances A and B appear to move into the cell by passive transport
 - Substances A and B appear to move into the cell by active transport
 - 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
- increasing the water potential in the guard cells
 - increasing the solute concentration in the guard cells
 - decreasing the strength of the guard cell walls to allow them to stretch open
 - decreasing the solute concentration in the guard cells
 - triggering the cytoskeleton of the guard cell to relax

79. Water moves through a plant by
 - (a) being pumped by active transport from vessel to xylem vessel
 - (b) being pumped by active transport within 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 house plant'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. If 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. Archegonium 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 mineval deficiency is likely to affect older leaves more than younger leaves if
(a) the mineval 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

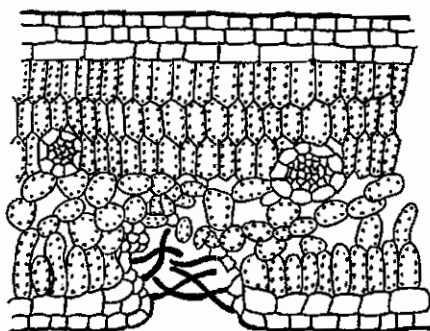
92. **Assertion** Chandramohan and others found that some exudates of the roots of rice inhibit germination of paddy grains.

Reason Allelopathy is a plant-plant interaction in which biochemical exudates act inimically towards one another.

Of the statements, mark the correct answer as :

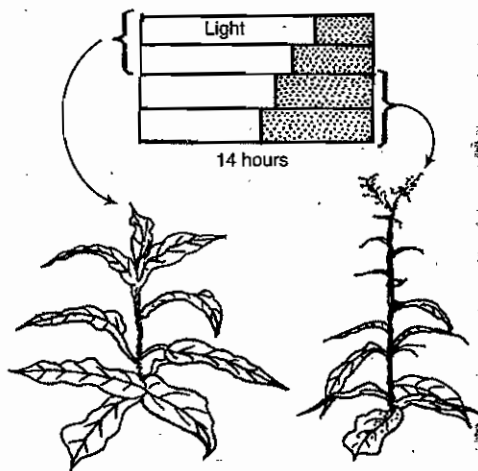
- (a) both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) both Assertion and Reason are true but Reason is not the correct explanation of Assertion
(c) Assertion is true but Reason is false
(d) Assertion is false but Reason is true

93. Transverse section in the given figure depicts anatomy of (2nd NSEE)



- (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?



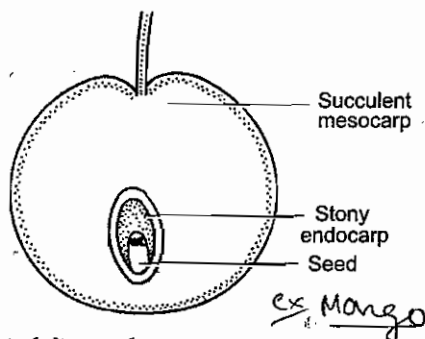
- (a) Increasing the day length causes these plants to flower
(b) They are photoperiod insensitive
(c) They are long-day plants
(d) The photoperiod threshold is about 14 hours
95. Gametophytic self incompatibility does not differ from sporophytic self incompatibility in that
(a) there is codominance of self incompatibility alleles
(b) both give 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 is
- -8
 - -7 bar
 - -5
 - -3 bar
97. If a dark period of a short day plant is interrupted by a flash of light, it will (3rd NSEB)
- flower immediately
 - produce many flowers
 - produce abnormal flowers
 - not produce flowers
98. The ratio of osmotic pressure exerted by 1 M sucrose and 1 M NaCl solution will be
- 1
 - 2
 - 0.1
 - 0.5
- (1st NSEB)
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?
- The electron carriers of photophosphorylation are located in the thylakoid membranes of the chloroplasts
 - During photophosphorylation, the chloroplast stroma becomes more acidic than the interior of the thylakoid membranes
 - Protons diffuse through protein channels which are ATP synthetase molecules
 - ATP is synthesized from ADP and P_i on the stroma side of the thylakoid membranes in the chloroplast
 - 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?
- The yeast cells respire aerobically if O_2 is bubbled through the brew
 - Gibberellic acid promotes stem elongation
 - Amylase enzyme converts starch to sugar
 - The plant hormone, abscisic acid, prevents barley seed germination
 - 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?
- Pea plants carrying the dwarf mutation would be expected to have higher levels of gibberellin in their stems than normal plants
 - If gibberellin is applied to the stems of dwarf pea plants, the stems elongate so the plant reach normal height
 - Dwarf pea plants have a mutation in the gibberellin biosynthetic pathway
 - Normal pea plants respond to gibberellin by growing even taller
 - The gibberellin produced by the fungus caused normal healthy rice plants to become unusually tall
102. Which statement about the function of the Casparian strip is correct?
- It prevents excess transpiration from leaves
 - It regulates ion movement into the root vascular cylinder
 - It prevents disease organisms from invading the plant
 - It prevents ions from leaking out of the xylem into leaves
 - 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)
- root cap
 - actively dividing region of the root cells
 - region of elongation
 - 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)
- sclereids and parenchyma
 - parenchyma and sclereids
 - collenchyma and parenchyma
 - 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
- provide them with high light intensity
 - keep them in the dark
 - provide them with a sugar solution
 - given 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?
- Absorption of carbohydrates from the endosperm
 - Photosynthesis
 - Storage of proteins
 - Vegetative propagation
107. What path does a carbon atom take in going from the atmosphere into the cell wall of a root cap cell?
- Stoma - Proplastid - Chloroplast - Vessel Element - Procambium - Apical meristem - root cap
 - Stoma - Chloroplast - Phloem - Apical meristem - Procambium - Root cap
 - Stoma - chloroplast - Vessel element - Procambium - Apical meristem - Root cap
 - Stoma - Chloroplast - Sieve tube - Procambium - Apical meristem - Root cap
 - 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?
- Light breeze
 - Bright sunshine
 - An afternoon rain shower
 - A plentiful supply of soil water
 - High temperature during the afternoon
109. Vessel elements of the xylem transport water and nutrients under negative pressure. Which of the following is not a characteristic of vessel elements?
- Cells are elongated in shape
 - Thickened rigid secondary walls are present
 - The end walls are lysed forming a perforation
 - Wide-diameter pores are present at the ends of the cell
 - The nucleus and cytoplasm undergo autolysis
110. Which of the following gives sexual reproduction an advantage over asexual reproduction?
- It produces more offsprings
 - It ensures the survival of the species
 - It increases the variation among the offsprings of an individual
 - It preserves parental genotypes
 - 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?
- Shoot apex
 - Wood
 - Root apex
 - Cambium between wood and bark
 - Expanding leaf
112. The main effect of cytokinins in plants is to
- increase the length of internodes on flowering stems
 - prevent the growth of lateral buds
 - regulate opening and closing of stomata
 - stimulate cell division
 - improve the quality of fruits
113. Which of the following structures of a flower are correctly matched with its main function?
- Anther-Produces sporocysts
 - Petal-Attracts pollinators
 - Ovary-Maintains the orientation of the flower
 - Sepal-Protect flower from pathogens
114. Which of the following plant hormones is correctly matched with its function?
- Abscisic acid -Promotes seed dormancy
 - Gibberellic acid-Promotes fruit ripening
 - Auxin -Promotes leaf senescence
 - 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
- the cell would burst
 - the vacuole would expand and burst
 - the cell and the vacuole would both shrink
 - the cell would shrink but the vacuole would remain the same size
 - nothing would happen, because a 3 M sucrose solution has the same osmotic pressure as the cell cytoplasm

Exercise II

- Leaves appear green because they reflect green colour from light spectrum. The part in the leaf that is actually responsible for this reflection is
 - inner membrane of chloroplast (2nd INBO)
 - thylakoid space
 - thylakoid membrane
 - stroma
- Wall of ovary of flowering plants gets converted as a result of fertilization. The type of ovary wall shown facilitates (2nd INBO)



- wind dispersal
 - animal dispersal
 - water dispersal
 - mechanical dispersal
- 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
 - vascular cambium
 - cork cambium
 - apical meristem
 - interfascicular cambium
 - Pericycle of roots is the site of origin of
 - lateral roots
 - secondary meristems
 - cork cambium
 - All of these
 - If you keep a C_3 plant and a C_4 plant of comparable size in an air-tight glass container and provide them with adequate sunlight, you would expect the C_4 plant to
 - grow better than the C_3 plant after one year in that condition
 - grow slower than the C_3 plant after one year in that condition
 - be able to survive longer than the C_3 plant, but ultimately die
 - be able to survive not as long as the C_3 plant

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

- 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 :

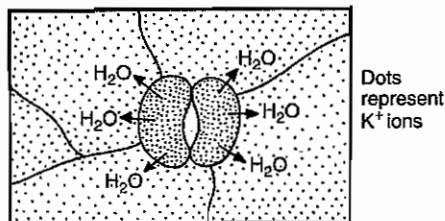
- I and II seeds in the dark
 - I and II seeds at various temperatures
 - the same number of I and II seeds
 - I and II seeds in separate trays
- A C_3 plant was grown at different temperatures : one below 28°C and one above 28°C . In which of the plants, the carbon loss due to photorespiration is more
 - Plant below 28°C
 - Plant above 28°C
 - Same for both
 - None of the above
 - Of the various biological processes listed below, the most ancient one is (2nd INBO)
 - photosynthesis
 - mitosis
 - meiosis
 - fermentation

- When sunlight is on the chloroplast, pH is lowest in the

- stroma
- cytosol
- space enclosed by the thylakoid membranes
- space enclosed by the inner and outer membranes

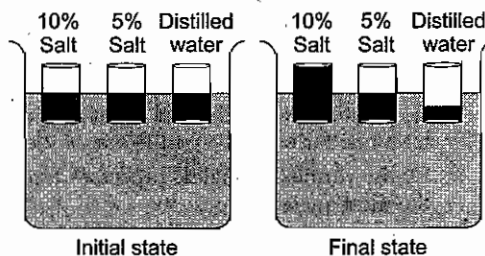
- In an experimental set-up, a group of C_3 and a group of C_4 plants were grown in an environment with double the amount of CO_2 concentration. Which group of plants would grow better and be more water efficient?
 - C_3 plants will be better than C_4 plants
 - C_4 plants will be better than C_3 plants
 - Both C_3 and C_4 plants will show equal growth
 - None of the above

12. The diagram illustrates stomatal closing. The major mistake in the diagram is (4th NSEB)

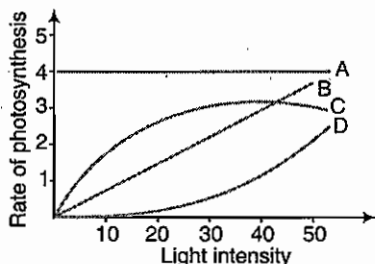


- (a) the concentration of the K^+ should be more outside the guard cells
 (b) the concentration of the K^+ should be equal on both inside and outside
 (c) the peripheral walls of the guard cells should be thicker
 (d) the water should move inside the guard cells

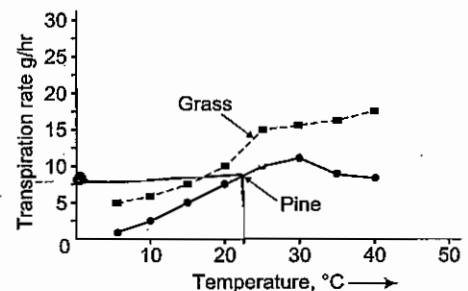
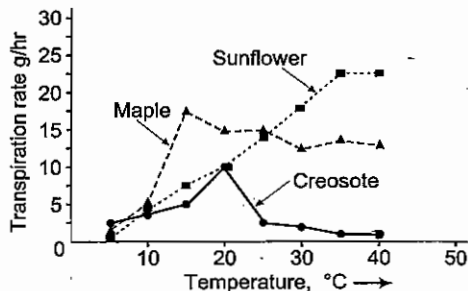
13. Three cylinders, each closed by a membrane permeable to water and containing a different fluid, are placed in the same solution. After adjusting to the solution, the fluid rises in one of the cylinders, remain the same in another, and falls in the third. The concentration of the solution in which 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 given h shows the effect of light intensity on the of photosynthesis?

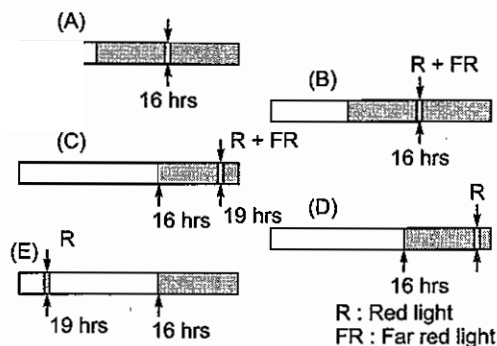


- (a) A (b) B
 (c) C (d) D
15. The graphs below show the relationship between the rate of water loss by transpiration and leaf temperature. Based on these results which plant is best adapted for conserving water in a hot dry environment?



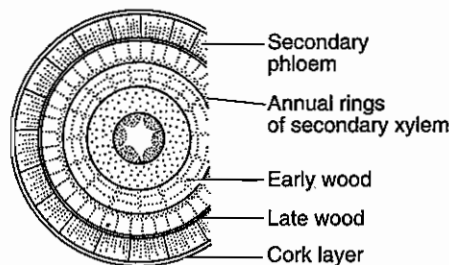
- (a) Sunflower (b) Maple
 (c) Creosote (d) Grass
 (e) Pine
16. Which of the following would be the least productive in trying work out the relationship between annual plants discovered in a large population which looked similar but which could be divided into two different size classes?
- (a) Measurement of photosynthetic capacity of plants from each size class and comparing such
 (b) Sequencing of genes from 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

to the plants. Analyse the situations and state the conditions under which the plant will flower (2nd INBO)



- (a) (A), (B) and (E) (b) (B), (C) and (E)
(c) (A), (C) and (D) (d) (A) and (D)

18. How many years old is the twig shown in the following figure?



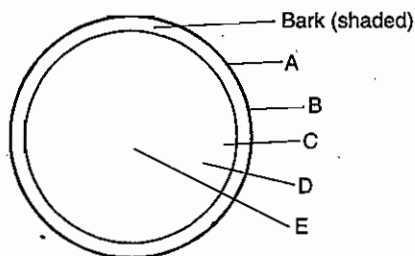
- (a) One (b) Two (c) Three (d) Five

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.



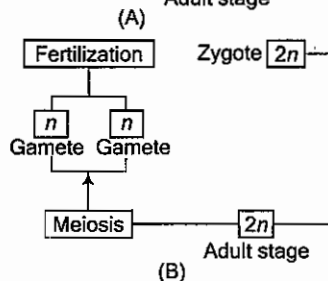
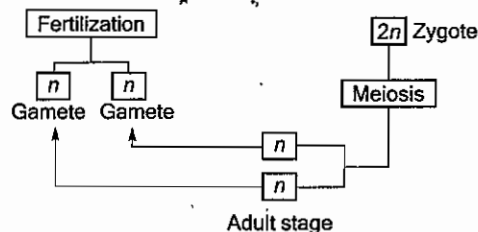
20. In which region of the trunk, would you expect to find the oldest cells?

- (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.

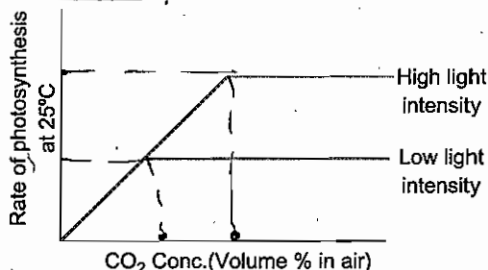


- (a) A represents primitive life forms and B represents more advanced life forms
(b) A represents terrestrial life forms and B represents aquatic life forms
(c) A represents asexual reproduction and B represents sexual reproduction
(d) both life forms basically represent the same life-cycle

23. Having one cotyledon distinguishes monocot seeds from dicot seeds. What other feature is to monocots?

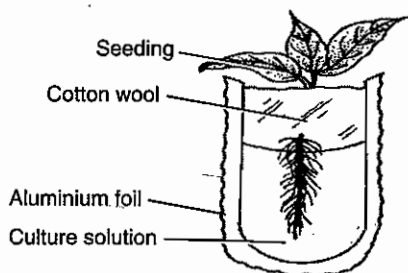
- (a) The nutrients required for germination are stored in the endosperm
(b) The shoot apical meristem is present at the time of germination
(c) The embryonic root is the first organ to penetrate the seed coat
(d) The root apical meristem is protected by a root cap
(e) The embryo is surrounded by a protective seed coat

24. The graph shows the relation between influence of light intensity and CO_2 concentration on the rate of photosynthesis of *Chlorella*:
Which one of the following statements explains the diagram correctly?



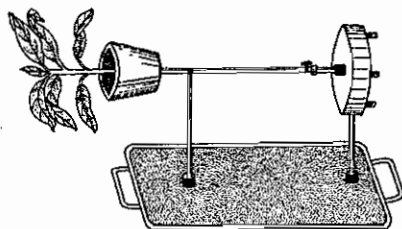
- (a) At low light intensity, the light-dependent reaction is rate limiting but at high light intensity, CO_2 is rate limiting
(b) The number of chlorophyll molecules limits the rate of photosynthesis
(c) Photosynthesis is independent of light intensity provided there is no total darkness
(d) Chlorophyll responds equally to light intensities and CO_2 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



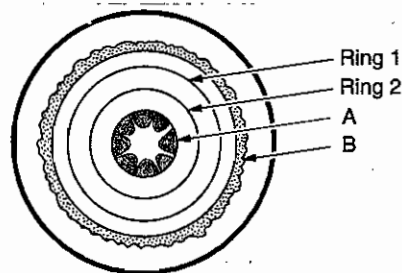
- (a) prevent the growth of algae
(b) prevent photosynthesis by the seedling
(c) keep the solution warm
(d) keep the tube upright

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



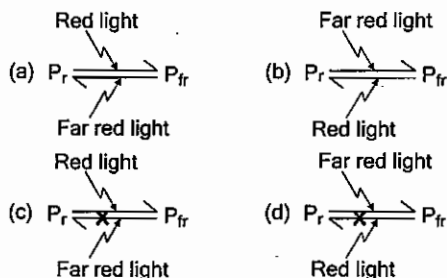
- (a) A photometer demonstrating transpiration rate of a plant
(b) Clinostat demonstrating the elimination of the effect of force gravity
(c) Clinostat demonstrating the upward growth of shoot and downward growth of root
(d) A photometer demonstrating phototropism

27. Transverse section of two year woody stem shown below. Numbers 1 and 2 indicate the two 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



29. Which of the following conditions would yield the highest rate of photosynthesis (as measured by the release of O_2)?

Light		Concentration of atmosphere CO_2
fluc. density (light intensity)	Range of wavelength (light quality)	
(a) $2000 \mu mol m^{-2} s^{-1}$	400 to 700 nm	350 ppm
(b) $2000 \mu mol m^{-2} s^{-1}$	100 to 400 nm	350 ppm
(c) $2000 \mu mol m^{-2} s^{-1}$	100 to 400 nm	250 ppm
(d) $1000 \mu mol m^{-2} s^{-1}$	500 to 600 nm	100 ppm
(e) $1000 \mu mol m^{-2} s^{-1}$	400 to 700 nm	100 ppm

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

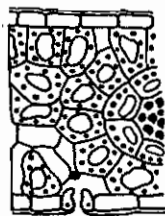


Fig. A



Fig. B ✓ (C3)

- (a) Fig. A and B represent stem and leaf anatomy respectively ✗
 (b) Fig. A is a leaf of C_4 plant and fig. B is leaf of C_3 plant ✗
 (c) Fig. A represents xerophyte stem and fig. B a mesophyte stem ✗
 (d) Both figures represent leaves of C_3 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.

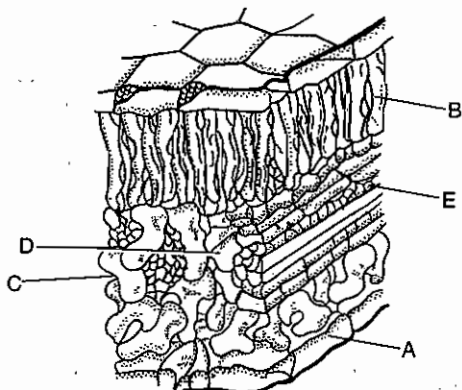
Plants that emerged in both sets were green. The correct interpretation of the experiment is

- (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.

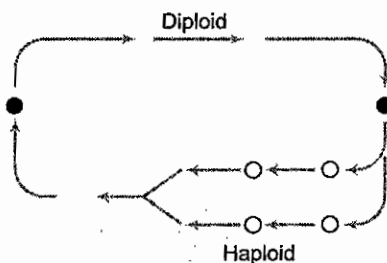
- (a) I and III
 (b) II and IV
 (c) I, III and IV
 (d) I and IV

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

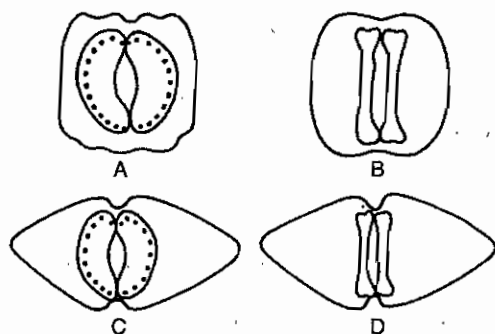
- (d) Nothing obvious would happen
(e) The nucleus will burst, but the cell will stay

36. Reproduction is often connected with a shift from haploid to diploid or the other way round. 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 NSEB)

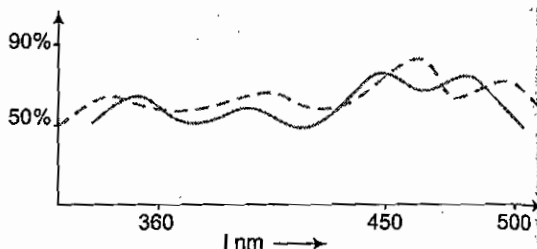


- (a) A (b) B
(c) C (d) D

38. Flowers pollinated by bees show certain characteristics/ structures that complement with aspects of the physiology of bees. These characteristics are

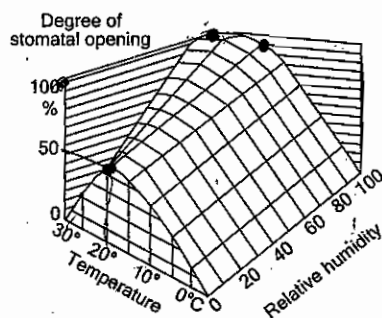
- (a) mostly blue or yellow flower petals
(b) odourless flowers
(c) superficial location of nectar glands
(d) nocturnal opening of flowers

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



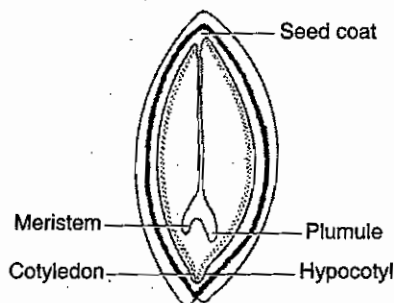
- (a) riboflavin (b) carotene
(c) chlorophyll (d) anthocyanin

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



- (a) low humidity and high temperature ✗
(b) high humidity and low temperature
(c) moderate humidity irrespective of temperature ✗
(d) high humidity and high temperature

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



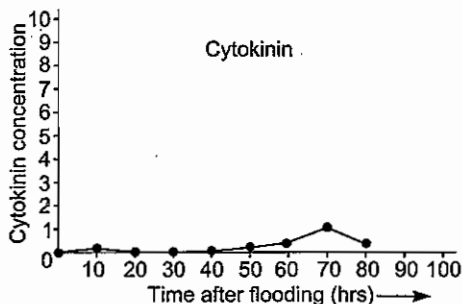
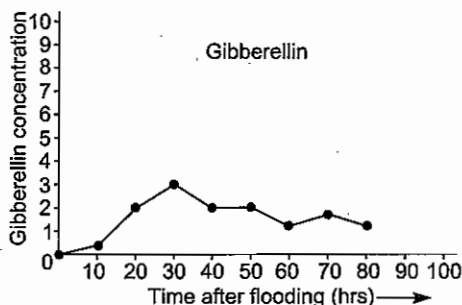
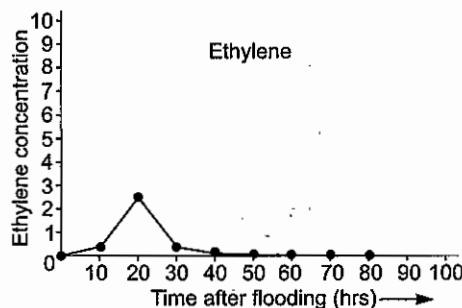
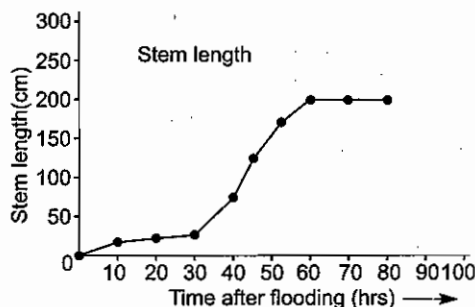
- (a) Cotyledon
(b) Hypocotyl
(c) Seed coat
(d) Meristem
(e) Plumule

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 (such as a developing fruit where products are used and stored). Which of the following statements about phloem transport is false?

(2nd CBO)

- Water enters the sieve tubes by osmosis
- Sieve tubes in a source have a low hydrostatic pressure
- Water and solutes move through the sieve tubes along a pressure gradient
- Solutes are actively removed from the sieve tubes in the sink area
- Solutes are 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.



- Ethylene alone
- Cytokinin alone
- Gibberellin alone
- Ethylene and gibberellin
- Cytokinin and gibberellin

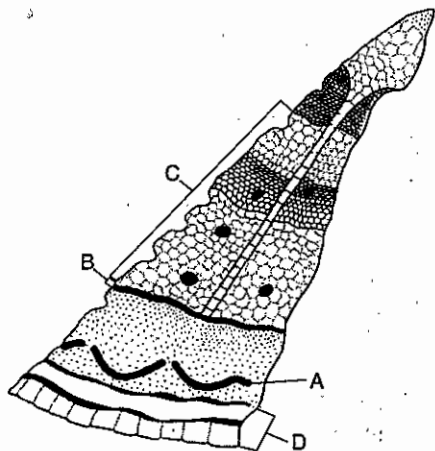
44. Plant cells can often grow larger than animal cells because

- photosynthesis produces more energy than does respiration
- plant cells need less food than animal cells
- plants use their energy for growth while animals spend much of their energy on movement
- plant cells have a cell wall which makes their surface to volume ratio very large
- 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?

- Tracheids, sclerenchyma fibres, collenchyma
- Sclerenchyma fibres, cork, cortex
- Sieve tubes, vessel elements, epidermis
- Sclerenchyma fibres, pith cells, epithelial cells
- Pith, cortex, xylem

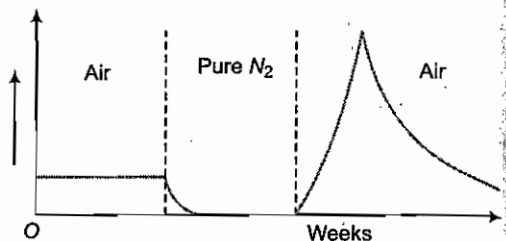
46. Under conditions of a high atmospheric humidity hardly any calcium (Ca) is transported developing fruits. This is caused by
- calcium only being transported through the xylem and this transport not taking place anymore
 - calcium only being transported through the phloem and this transport not taking place anymore
 - transpiration stopping and, as a result both xylem and phloem transport stopping
 - 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.



- A-Secondary phloem, B-Vascular cambium, C-Secondary xylem, D-Periderm
- A-Secondary xylem, B-Cambium, C-Secondary phloem, D-Protoderm
- A-Secondary phloem, B-Periderm, C-Secondary xylem, D-Cambium
- A-Vascular cambium, B-Secondary phloem, C-Secondary xylem, D-Periderm

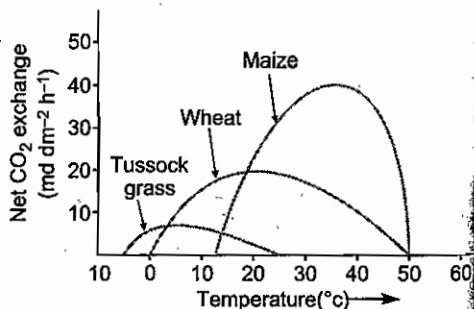
48

Plants are stored during one week in pure air, after this during one week in pure nitrogen and in pure air again. During the experiment, the excretion of CO_2 is measured. The diagram shows the results.



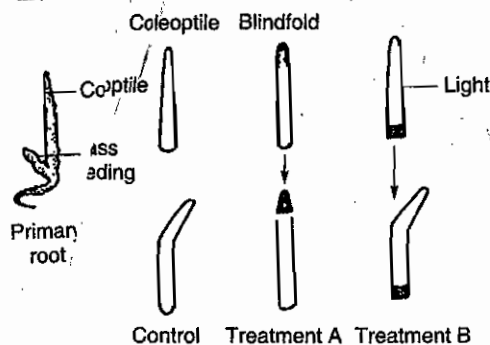
The extra amount of CO_2 produced and excreted during the third week probably is originating from

- ethanol
 - ethanal
 - lactic acid \times
 - NADH_2
49. Which of the following statements about the Calvin cycle are false?
- The first stable product of the cycle is 3-phosphoglycerate
 - The reducing power of NADPH is used to reduce 3-phosphoglycerate to glyceraldehyde 3-phosphate (PGAL)
 - The carboxylation of the 5-carbon sugar ribulose 1, 5 bisphosphate (RuBP) is catalysed by the rubisco enzyme (ribulose bisphosphate carboxylase / oxygenase)
 - Light is not required for the operation of the Calvin cycle
 - 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 (a C_3 species); wheat from the temperate zone (C_3), maize from the subtropics (C_4). Which statement about these relationships is false?



- Wheat is the species that has the highest rate of photosynthesis when temperatures are around 25°C
- Maize shows maximum photosynthetic rate at 38°C
- V_2 shows maximum photosynthetic rate at 2
- In C_3 pathway, where mean temperatures were 10°C , C_3 species would have higher photosynthetic rates than C_4 species
- In the arctic tundra, where mean daily temperatures might be as low as 0°C , the C_3 tussock grass 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 results?

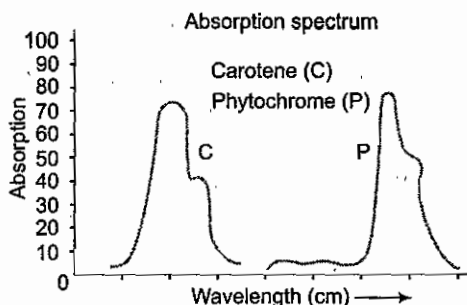
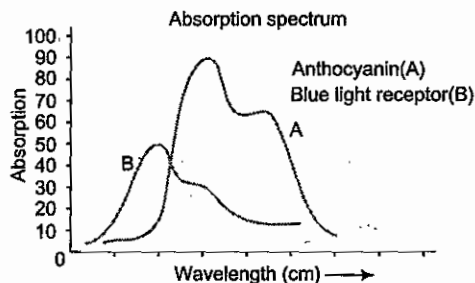
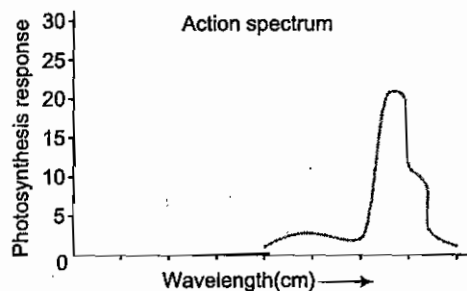


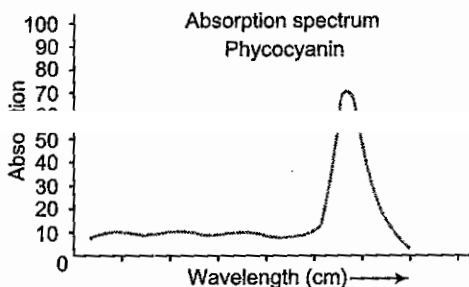
- The light signal is perceived a few millimetres below the tip, and these cells cause the coleoptile to grow toward the light
- Both the seedling root and coleoptile perceive and respond to light in the same manner
- A chemical messenger must travel from the base of the coleoptile to the tip
- The light signal is perceived at the tip of the coleoptile, but the growth response occurs a few millimetres below the tip
- The coleoptile bends because cells on the side toward the light grow faster than those on the shaded side

The pressure flow hypothesis for the mechanism of phloem transport was developed over 60 years ago by the German plant physiologist Ernst Muenh and still remains the 'front runner' as an explanation of how the plant moves carbohydrates over long distances. Which of the

following observations provides direct support for Munch's hypothesis?

- Transpiration occurs from open stomata on leaves and stems during the day
 - Turgor pressure in the sieve tubes of a fully expanded tomato leaf is higher than the turgor in the sieve tubes of a developing tomato fruit
 - Vessels transport water under negative pressure
 - Carbohydrates move within the plant from sink to source
 - The osmotic potential of the sieve tubes in a root tip is more negative than that of the sieve tubes in the leaf
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 pigment responsible for phototropism.





- (a) Anthocyanin
- (b) Blue light receptor
- (c) Carotene
- (d) Phytochrome
- (e) Phycocyanin

54. Compared to C_3 plants, C_4 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?

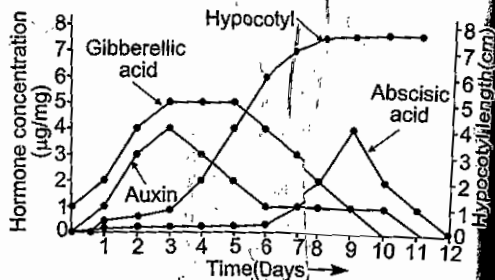
- (a) Stomata normally open in response to a shift from dark to light conditions
- (b) When the turgor pressure of guard cells increases, the stomatal aperture opens
- (c) With the shift from dark to light, the osmotic potential becomes less negative, resulting in stomatal closure
- (d) The turgor pressure of guard cells increases after the osmotic potential becomes more negative
- (e) H⁺-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

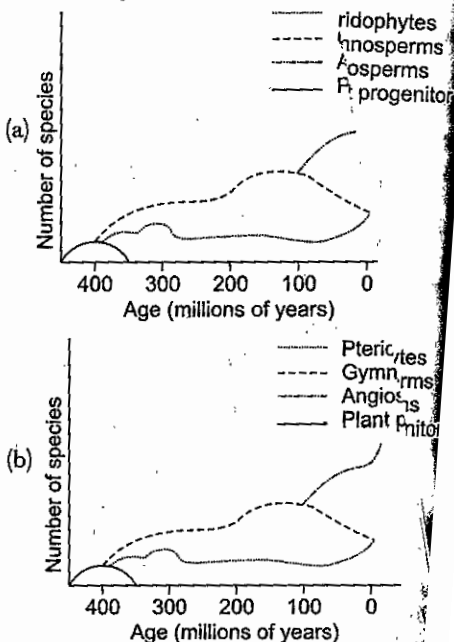
- (c) Rate of transpiration from the leaves
- (d) Rate of carbohydrate loading
- (e) Rate of auxin synthesis

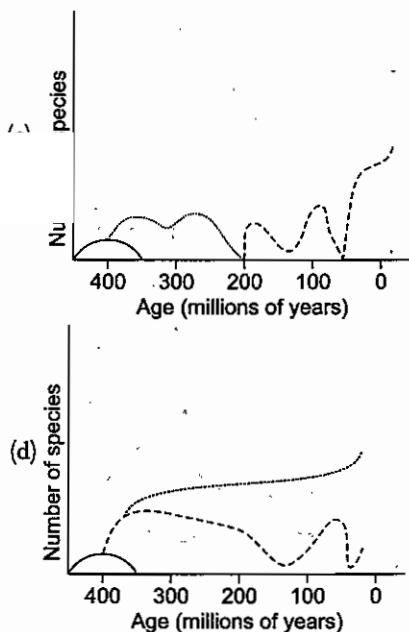
germination. The graph shows changes in hormone concentrations (left axis) and hypocotyl growth (right axis) over time for mung bean. Which hormone(s) most likely regulates hypocotyl (bean sprout) growth during mung bean germination?



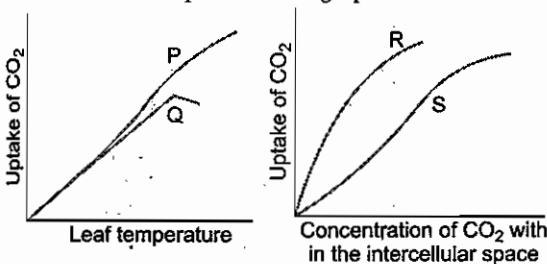
- (a) Gibberellic acid alone
- (b) Auxin alone
- (c) Abscissic acid alone
- (d) Both (a) and (b)
- (e) Both (b) and (c)

58. Which of the following graphs correctly depicts the evolution of various vascular plant species in evolutionary time scale?





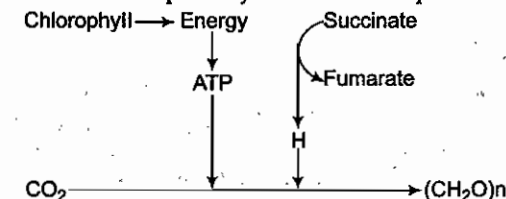
59. Photosynthetic features of four plants P, Q, R, and S are depicted in the graphs below.



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
 (e) P: C₃ plant Q: C₄ plant R: C₃ plant S: C₄ plant

60. The nutritional pathway shown below represents



- (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 ψ_p (pressure potential) and ψ_s (solute potential) root xylem and root parenchyma, in kPa. In which of the alternatives (a-d) would transpiration pull cause water to move from root parenchyma into the root xylem?

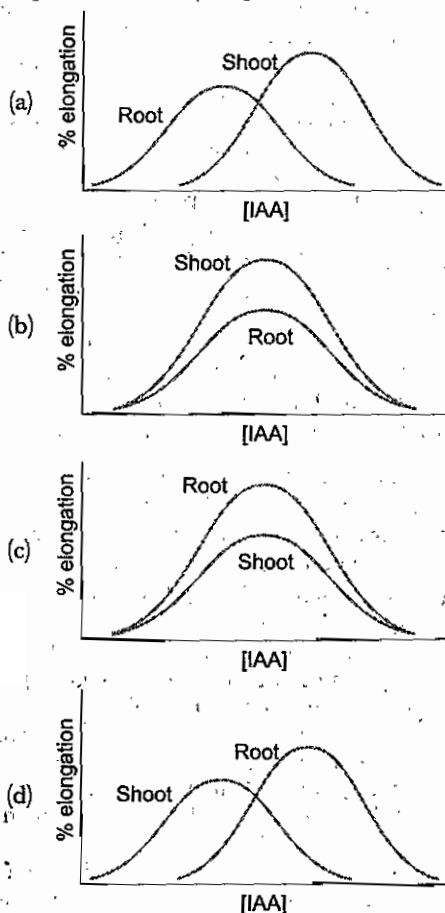
	Root parenchyma		Root xylem	
	ψ_p	ψ_s	ψ_p	ψ_s
(a)	200	-190	-200	5
(b)	-200	220	65	-5
(c)	200	-220	65	-5
(d)	200	-220	-65	-5

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 amphibian*, 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

- to give mechanical strength to the root cap
- to provide ready source of energy required for rapid cell divisions at the root tip
- to exert pressure along the physically lower side of the cell to ensure positive geotropism
- to help replacing the worn out cells of the root cap

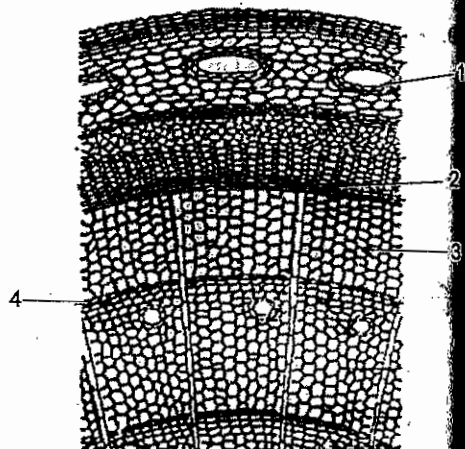
65. Auxin at an appropriate concentration can induce cell elongation in certain plant organs. However, tissues respond differently to different concentrations of auxin. Which graph best represents the IAA response of shoot and root?



66. A few characteristics of C_3 and C_4 plants are compared in the following table. Place > or < or = or X (cannot be determined) in the empty place in the table given below.

Characteristic	Type of plant	>/</=/X	Type of plant
(a) Light compensation point	C_3 plants		C_4 plants
Photorespiratory rate	C_3 plants		C_4 plants
Optimum temperature for photosynthesis	C_3 plants		C_4 plants
Productivity	C_3 plants		C_4 plants

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, Mucilage duct, Cuticle, Phloem, Primary ray, Pith, Periderm

-
-
-
-

68. Some orders under Pteridophyta are characterized by homosporous *i.e.*, production of only one type of spores that grow independent, bisexual gametophyte while others are known to exhibit heterosporous *i.e.*, production of male/microspores and female/megaspores.

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 appropriate boxes in the table given in the sheet.

- I. Homospory is an advanced feature involving development of an independent bisexual gametophyte.
- II. Heterospory is a primitive feature since a greater amount of energy is spent for reproduction
- III. Eeterospory is a transitional evolutionary stage in the evolution of spermatophytes since

it involves retention of spores and gametophytes in the sporangia.

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

Statement	True	False
I		
II		
III		
IV		

Answers

Exercise 1

- | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. (b) | 2. (c) | 3. (b) | 4. (b) | 5. (a) | 6. (c) | 7. (a) | 8. (c) |
| 9. (a) | 10. (d) | 11. (c) | 12. (c) | 13. (d) | 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. (d) | 90. (c) | 91. (b) | 92. (b) | 93. (b) | 94. (d) | 95. (d) | 96. (c) |
| 97. (d) | 98. (d) | 99. (b) | 100. (e) | 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

66.

Characteristic	Type of plant	>/</=/ \times	Type of plant
Light compensation point	C ₃ plants	>	C ₄ plants
Photorespiratin rate	C ₃ plants	>	C ₄ plants
Optimum temperature for photosynthesis	C ₃ plants	<	C ₄ plants
Productivity	C ₃ plants	<	C ₄ plants

67. 1. Mucilage duct

2. Cambium

3. Spring wood

4. Autumn wood

68.

Statement	True	False
I		✓
II		✓
III	✓	
IV	✓	