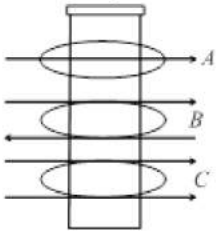
# TRANSPORT IN PLANTS

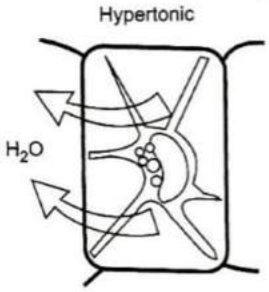
1. The given diagram shows cotransport method of two molecule. Labelled it correctly and choose the correct option accordingly




a) A-Uniport, B-Symport, C-Antiport
b) A-Uniport, B-Antiport, C-Symport
c) A-Symport, B-Uniport, C-Antiport
d) A-Antiport, B-Uniport, C-Uniport

2. What are the aquaporins in facilitated diffusion process?
a) Membrane proteins b) Carrier proteins c) Channel proteins d) Carrier lipids

3. Which of the following osmotic situations does the figure demonstrate?



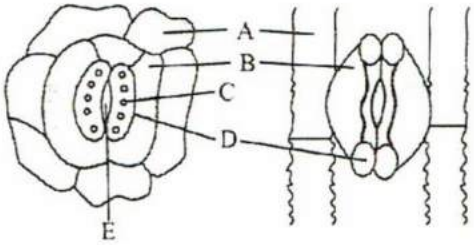

a) Plasmolysis
b) Turgid
c) Reverse plasmolysis
d) Diffused

4. Read the following statement and choose the correct one from the codes given below
I. The apoplastic movement of water takes place exclusively through intercellular spaces and cell wall without crossing any membrane
II. Symplastic movement occurs from cell to cell through plasmodesmata, *i. e.*, adjacent cells are connected through plasmodesmata
III. Permeability of a membrane depends on its composition and chemical nature of the solute
IV. Solutes present in a cell increases the free energy of the water or water potential
a) I, II and III b) I, II and IV c) II and IV d) I and IV

5. When sugars enter sieve tubes, water flows by osmosis, resulting in
a) Water potential b) Osmotic gradient c) Turgor pressure d) DPD

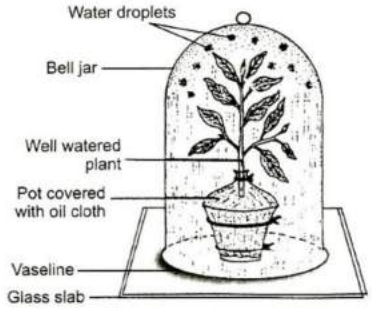
6. The evaporative loss of water from the exposed part of plant is called
a) Transpiration b) Guttation c) Loss of water d) Water bleeding

7. Which one of the following is not related to guttation?
   a) Water is given out in the form of droplets
   b) Water given out is impure
   c) Water is given out during daytime
   d) Guttation is of universal occurance
8. Whose water potential is less than water potential of root hair during the water absorption by root hair?
   a) Gravitational water
   b) Soil solution
   c) Pure water
   d) Vacuolar sap
9. A thin film of water is held by the soil particles under the influence of internal attractive force. It is called
   a) Hygroscopic water
   b) Gravitational water
   c) Combined water
   d) Capillary water
10. Study the following statement and choose the correct option(s) from the codes from below
   I. Root pressure provides a light push in the overall process of water transport
   II. Root pressure causes the flow of water faster through xylem than it can be lost by transportation
   III. In symplast pathway, water move exclusively through the cell wall and intercellular spaces
   IV. Guttation is a cause of transpiration pull
   V. Most plants fulfill their water requirement by transpiration pull
   a) I, II and III are correct while IV and V are incorrect
   b) IV and V are correct while I, II and III are incorrect
   c) I and V are correct
   d) II and III are correct while I, IV and IV are incorrect
11. What is required for the transport of substances through a membrane from a region of lower concentration to higher concentration?
   a) Input of energy
   b) Output of energy
   c) Facilitated diffusion
   d) Nothing is required
12. Which of the following statement is correct?
   a) DPD=OP-WP
   b) DPD=OP+WP
   c) DPD=WP-OP
   d) DPD=TP+OP
13. Choose the correct combination of labeling of stomatal apparatus of dicot and monocot leaves




   a) A-Epidermal cells B-Subsidiary cells C-Chloroplast D-Guard cells E-Stomatal aperature
   b) A-Epidermal cells B-Guard cells C-Chloroplast D-Subsidiary cells E-Ctomatal aperature
   c) A-Epidermal cells B-Subsidiary cells C-Chloroplast D- Stomatal aperature E- Guard cells
   d) A- Subsidiary cells B- Epidermal cells C-Chloroplast D- Stomatal aperature E- Guard cells
14. In a plant organ, which is covered by periderm and in which the stomata are absent, some gaseous exchange still takes place through
   a) Aerenchyma
   b) Trichomes
   c) Pnenumatophores
   d) Lenticels
15. Identify the correct statements from the following:
   I.Accumulation of $K^+$ ions in the guard cells does not require energy.
   II.A high pH favours stomatal opening.
   III.Movement of chloride ions into the guard cells accrues in the response to the electrical differential created by $K^+$ ions.
   IV.With the entry of several $K^+$ ions and chloride ions, the water potential of guard cells increases.
   a) I and III
   b) I and II
   c) II and III
   d) III and IV

16. Which one of the following is the reason for higher rate of transpiration in *Sorghum* as compared to maize?
    a) Increased shoot/root ratio
    b) Increased rate of respiratory quotient
    c) Increased rate of phototsynthesis
    d) Decreased shoot/root ratio
17. If turgidity of a cell surrounded by water increases, the wall pressure will
    a) Increase
    b) Decrease
    c) Fluctuate
    d) Remain unchanged
18. In plants; which of the following are/is translocated through phloem?
    a) Hormones
    b) Amino acids
    c) Sugars
    d) All of these
19. Root pressure is due to
    a) Diffusion
    b) Passive transport
    c) Active transport
    d) Osmosis
20. What is depicted by the given diagram below?




    a) Measuring the rate of transpiration
    b) Demonstration of ascent of sap
    c) Demonstration of transpiration
    d) Both (a) and (c)
21. Choose correct statements regarding the flow of sap in xylem?
    I. Flow is driven by higher concentration of sugar in the vessel elements
    II. Flow from root to twigs and leaves would be reduced if leaves are removed
    III. In the morning, sap begins to flow first in the twig then in trunk
    IV. Rapid flow of water put tissues under pressure much more than atmospheric pressure
    a) I and IV
    b) II and III
    c) I, II, III and IV
    d) No one is correct
22. Stomatal opening is regulated by
    a) Light
    b) Temperature
    c) Atmospheric humidity
    d) Wind
23. The direction of movement in phloem is ...A... and that of xylem is ...B... .
    Choose the correct pair of options
    a) A-downwards; B-downwards
    b) A-only upwards; B-only downward
    c) A-unidirectional; B-bidirectional
    d) A-bidirectional; B-unidirectional
24. Which of the following theories for ascent of sap was proposed by an eminent Indian scientist J C Bose?
    a) Pulsation theory
    b) Relay pump theory
    c) Transpiration pull theory
    d) Root pressure theory
25. The potential energy of water is referred as
    a) Water potential
    b) Osmotic potential
    c) Gravity potential
    d) Pressure potential
26. If two solutions have the same osmoregularity, they are said to be
    a) Hypertonic
    b) Hypotonic
    c) Isotonic
    d) None of these
27. Plant obtain carbon and most of their oxygen from
    a) Soil
    b) Water
    c) $CO_2$ from the atmosphere
    d) Symbiotic organisation
28. When plant cell is kept in saline drip, cell
    a) Decrease in size
    b) Bursts out
    c) Increase in size
    d) Unchanged

29. Carrier protein, which allows the diffusion of two type of molecules in the same direction is
a) Symport b) Antiport c) Both (a) and (b) d) Uniport

30. Hydroponics is the method of
a) Water conservation
b) Plant development in water without soil
c) Plant development without soil
d) Plant development in saline soil

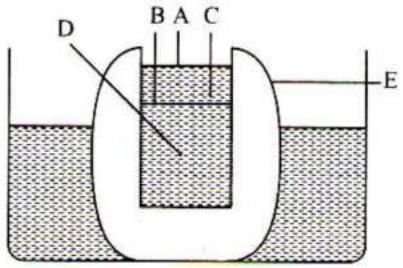
31. Imbibition is always accompanied by swelling or increase in the volume of imbibint However, the increase in the volume of the imbibant is
a) More than the volume of water imbibed
b) Same as the volume of the water imbibed
c) Less than the volume of the water imbibed
d) Depends upon the type of imbibant

32. Which of the following is responsible for the transport of water and minerals from roots to stems, leaves, flowers and fruits in rooted plants?
a) Xylem b) Phloem c) Either (a) or (b) d) Both (a) and (b)

33. Loss of liquid water by guttation occurs through
a) Hydathodes b) Stomata c) Cuticle d) Bark

34. The process by which water is absorbed by solids like colloid causing them to increase in volume, is called
a) Osmosis b) Plasmolysis c) Imbibition d) Diffusion

35. Choose the correct combination of labeling of the potato osmoscope experiement.




a) A-Final level B-Dotpin
C-Initial level D-Sugar solution
E-Potato tuber

b) A-Initial level B-Dotpin
C-Final level D-Water
E-Potato tuber

c) A-Final level B-Dotpin
C-Initial level D-Water
E-Potato tuber

d) A-Final level B-Dotpin
C-Initial level D-Water
E-Container

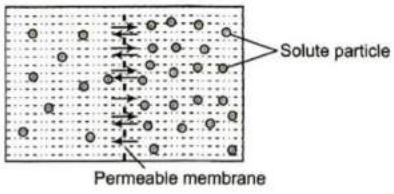
36. How will you distinguish between the method of transport between xylem and phloem?
a) Active transport move xylem but not phloem sap
b) Transport, in xylem is unidirectional and saps move upward, while phloem sap moves ups and down
c) Transpiration does not move xylem sap, but it moves phloem saps
d) Transport of substances take place from source to sink by both the tissues

37. Which one of the following is not an antitranspirant?
a) PMA b) BAP c) Silicon oil d) Low viscosity

38. Statoliths are involved in

a) Phototropism b) Hydrotropism c) Chemotropism d) Gravitropism

39. In plasmolysed cell, the space between nucleus and plasma membrane is occupied by
    a) Hypotonic solution b) Hypertonic solution
    c) Isotonic solution d) Air
40. The sugarcane plant has
    a) Dumb bell-shaped guard cells b) Pentamerous flowers
    c) Reticulate venation d) Capsular fruits
41. Water potential and osmotic potential of pure water is
    a) Zero and zero b) 100 and zero c) 100 and 100 d) Zero and 100
42. When pea seeds and wheat seeds are put in water, which of the two will imbibe more water?
    a) Wheat seeds b) Pea seeds
    c) Both will imbibe equal amount of water d) Pea seeds imbibe water only at alkaline pH
43. Nyctinasty and seismonasty in plants like bean and touch me not are produced due to
    a) Reversible osmotic potential in the cells
    b) Reversible turgor pressure in the cell of their pulvini
    c) Due to less pressure potential in the cells
    d) Presence of less turgidity in the cells
44. Following statements are related with the diffusion of coloured molecules across a membrane. Select the correct statement, which shows the fastest rate of diffusion?
    a) An internal concentration of 15% and external concentration of 10% b) An internal concentration of 25% and external concentration of 50%
    c) An internal concentration of 50% and external concentration of 25% d) Both (b) and (c) shows fastest rate of diffusion
45. Choose the false statement
    a) If bark of tree is girdled from main stem, the plant dies because ascent of sap is stopped
    b) If xylem is girdled from main stem, wilting of leaves tales place
    c) In the flowerering plant food is transported in the form of dissacharide sucrose
    d) In Girdling experiment, in a plant, root dies first
46. Sunken stomata is found in the leaves of
    a) *Trifolium* b) *Lemma* c) *Nerium* d) *Lilium*
47. Who proposed cohesion theory of water movement in plants?
    a) JC Bose b) Priestly c) Dixon and Jolly d) TV Englemann
48. Study the following picture and the statements given below and choose the correct option




    I. The above diagram shows the net movement of water from the dilute to concentrated solution
    II. The two solutions are separated by a differentially permeable membrane
    III. Water molecule strikes the membrane randomly on both the sides and pass through the same
    IV. Diffusion of water does not occur from its lower chemical potential to higher chemical potential
    a) I, II, III and IV b) I, II and III c) I, II and IV d) I and IV
49. Read the following statements and choose the correct option given below
    I. Major account of transpiration takes places through surface/margin of leaves
    II. A little amount of water is lost through stem, this is reffered to cauline transpiration
    III. Transpiration is comparatively a slow process then evaporation

IV. Transpiration driven ascent of sap does not depend on cohesion, adhesion and surface tension properties of water

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

50. Direction of translocation of organic food or solutes, is

a) Upward b) Downward c) Radial d) All of these

51. The water available to plants for absorption is

a) Gravitational water b) Hygroscopic water

c) Capillary water d) Chemically bound water

52. Which of the following theory gives the latest explanation for the closure of stomata?

a) ABA theory b) Munch theory

c) Starch glucose theory d) Active $K^+$transport theory

53. What will be the effect of accumulation of $K^+$ions in guard cells?

a) Water potential increases b) Water potential decreases

c) Loss of turgidity d) Exosmosis

54. Why all the minerals present in soil can not be passively absorbed by roots?

a) Mineral existence as ions is more than absorption

b) Due to less concentration of ion in root interior than soil

c) Due to more concentration of ions in root interior than in soil

d) None of the above

55. Which one is not the job of zone of cell differentiation in roots?

a) Mineral uptake b) Water uptake c) $CO_2$ uptake d) $O_2$ uptake

56. Which one is against the theory of ascent of sap given by Dixon and Jolly?

a) Pores in treachery elements b) Cohesion force of water molecules

c) Adhesion force of water molecules d) Requirement of ATP

57. Attraction of water molecules to polar surfaces is known as

a) Cohension b) Capillarity c) Surface tension d) Adhesion

58. The epidermal trichomes help in

a) Transpiration and exchange of gases b) Protection from desiccation

c) Protection and reduction of transpiration d) Exudes water drops from their tips

59. In land plants, the guard cells differ from other epidermal cells in having

a) Mitochondria b) Endoplasmic reticulum

c) Chloroplasts d) Cytoskeleton

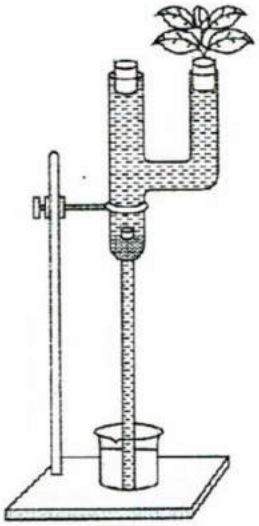
60. The values of osmotic potential (π) and pressure potential (ρ) of cells A, B, C and D are given below.

| Cell | π | ρ |
|---|---|---|
| A | -1.0 | 0.5 |
| B | -0.6 | 0.3 |
| C | -1.2 | 0.6 |
| D | -0.8 | 0.4 |

Identify the correct sequence that shows the path of movement of water from among the following.

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

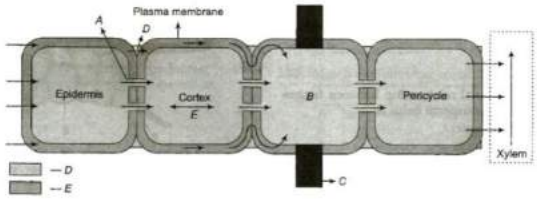
61. The experimental set up shown in the adjacent diagram is for



a) The demonstration of development of suction force due to transpiration
b) Measuring the rate of transpiration
c) The demonstration of ascent of sap
d) The demonstration of anaerobic respiration

62. Arrange the events of opening stomata in correct sequence and choose the correct option accordingly
I. Lowering of osmotic potential of guard cells
II. Decline in guard cell solute
III. Rise of potassium ion level in guard cells
IV. Guard cells absorb water from neighbouring epidermal cells
V. Guard cells become flaccid
VI. Guard cells swells and make a pore between them
a) III, I, IV, V b) I, II, III, IV, V, VI c) III, I, IV, VI d) III, I, IV, VI, II, V

63. In the given flow chart, the pathway of water movement is shown from soil to xylem. Identify A-E and choose the correct option accordingly




a) A-Stomatal pore, B-Endodermis, C-Casperian strip, D-Symplast, E-Apoplast
b) A-Plasmodesmata, B-Palisade, C-Medullary rays, D-Symplast, E-Apoplast
c) A-Plasmodesmata, B-Endodermis, C-Casperian strip, D-Apoplast, E-Symplast
d) A-Stomatal pore, B-Guard cell, C-Medullary rays, D-Apoplast, E-Symplast

64. Water potential increases due to
a) Addition of solute
b) Evaporation
c) Addition of inorganic substances
d) Increase in pressure

65. Why seeds imbibe and swell after keeping in water?
a) OP inside the seed is low
b) OP of water is high
c) Water potential gradient developes between the seed coat and water
d) Diffusion pressure deficit of seed is very high

66. If you are given a task to analyse phloem sap chemical, which of the following will be present in least concentration?
a) Water
b) Sugar
c) Minerals and nitrogen
d) Hormones

67. Some elements like calcium are not remobilised because they are
a) Structural component b) Heavy metals c) Less charged d) Macromolecules

68. Movement of molecules in three forms of matter, from a region higher concentration to a region of lower concentration can be termed as
a) Osmosis b) Passive transport c) Diffusion d) Active transport

69. In plants, water supply is due to
a) Osmosis b) Imbibitions c) Guttation d) Adhesion force

70. Which part of root absorbs both water and minerals?
a) Zone of cell differentiation b) Zone of cell formation
c) Zone of cell elongation d) Terminal portion of root

71. Diffusion pressure deficit is also called
a) Suction pressure b) Turgor pressure c) Osmotic pressure d) None of these

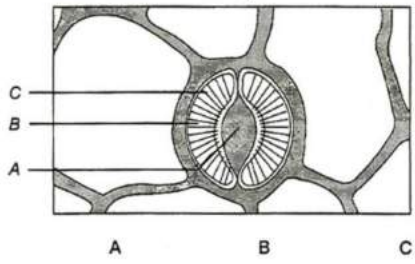
72. Which of the following transport induces conformational changes in proteins?
a) Simple diffusion b) Osmosis c) Facilitated diffusion d) Plasmolysis

73. Diffusion, a process occur(s) along the concentration gradient is actively involved in
a) Transpiration b) Respiration c) Photosynthesis d) All of these

74. Which of the following mechanism can explain the transport of sucrose from source to sink?
a) Osmotic movement of water into sugar loaded sieve tube cells which create a higher hydrostatic pressure into the source than in the sink
b) Tension created by differences in pressure potential between source and sink
c) Active absorption of sucrose through sieve tube membrane driven by a specific pump
d) Transpiration and active transport of sugar from source to sink

75. Which of the following cells are not related to the structure of stomata?
a) Sclerenchymatous cells b) Epidermal cells
c) Guard cells d) Accessory cells

76. Choose the correct option to label *A-C* in the given diagram of stomatal apparatus




| | A | B | C |
|---|---|---|---|
| a) | Stomatal aperture | Subsidiary | Guard cells |
| b) | Cellulose micro fibrils | Subsidiary cells | Stomatal aperture |
| c) | Stomatal aperture | Guard cell | Epidermal cells |
| d) | Stomatal aperture | Guard cell | Cellulosic micro fibrils |

77. Water lost in Guttation is
a) Pure water b) Impure water c) In vapour form d) Either (A) or (B)

78. The approximate length of root hair zone in plants
a) 1-10 cm b) 1-15 cm c) 1-6 cm d) 1-20 cm

79. When the conditions are dry, a grass leaf curls inward to minimize water loss due to the pressure of
a) Thick cuticle b) Large xylem cavities
c) Parallel venation d) Bulliform cells

80. Cell A has $\Psi_w - 3$ bars and cell B has $\Psi_w - 8$ bars. The movement of water will be from
a) Cell A to cell B

b) Cell B to cell A
c) Data insufficient
d) Water can not move in negative value of ΨW

81. Transpiration is measured by
a) Photometer b) Porometer c) Auxanmeter d) Respirometer

82. A cell swells up when kept in
a) Hypotonic solution b) Hypertonic solution
c) Isotonic solution d) All of the above

83. Which of the following statements are true/false?
I. The positive hydrostatic pressure is called turgor pressure.
II. Wall pressure exerts to prevent the increase of protoplasm size.
III. Diffusion is more rapid in liquids than in gases.
IV. Diffusion of water through a semi-permeable membrane is called imbibition.
V. Osmosis is movement of substance, which takes place along a diffusion gradient.
a) I and II are true, while III, IV and V are false
b) I and III are true, while II, IV and V are false
c) I and IV are true, while II, III and V are false
d) I and IV are true, while II, III and IV are false

84. When a plasmolyzed cell is placed in a hypotonic solution then water will move inside the cell. Which force causes this?
a) DPD b) OP c) WP d) None of these

85. Which one of the following denotes the water potential of the mesophyll cell in wilted condition?
a) Equal to the value of osmotic potential
b) Equal to the value of pressure potential
c) Greater than the value of its osmotic potential
d) Equal to zero

86. Sugar stored in roots may be mobilised to become a source of food in the
a) Winters b) Early spring c) Summers d) Early summers

87. Choose true and false statements from the following
I. Mycorrhizal association between fungus and root of plant (*Pinus*) is often obligate
II. *Pinus* and orchid seeds can germinate and grow into plant in absence of mycorrhizal association
III. Absorption of water along with mineral solute by root hairs is purely a process of diffusion
IV. In apoplast pathway, movement of water takes place through cell wall and intercellular spaces
V. Fungal hyphae provide sugar and organic internal to root
Choose the correct option
a) I, II and III are true while IV and V are false
b) IV, and V are true while I, II and III are false
c) I and IV are true
d) I, II and V are true

88. Which of the following is the unit of measurement of water potential?
a) Watt b) Joule c) Pascal d) Litre

89. Which type of water is used by the plants?
a) Gravitational water b) Capillary water c) Hygroscopic water d) Bound water

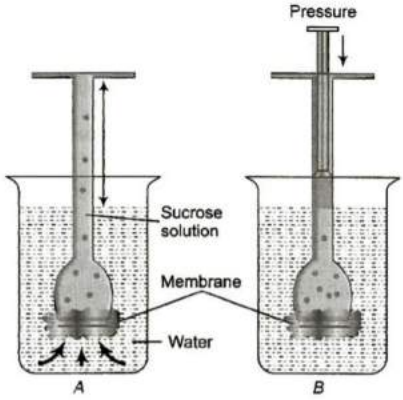
90. Water in the vessel of xylem in tall plant is
a) Pushed
b) Pulled
c) Pulled and pushed

d) First pushed and it is pulled slowly

91. Sunken stomata are usually found in the leaves of
a) Xerophytes b) Hydrophytes c) Mesophytes d) Sciophytes

92. A leaf peeling of *Tradescantia* is kept in a medium having 10% NaCl. After a few minutes, if we observe the leaf peel under the microscope, we are likely to see
a) Entry of water into the cell b) The cells bursting out
c) Diffusion of NaCl into the cell d) Exit of water from the cell

93. Identify the process taking place in the given experimental setup and choose the correct option




a) Osmosis b) Plasmolysis c) Imbibition d) Diffusion

94. Stomata which can open at night, are present in
a) Xerophytes b) Gametophytes c) Hydrophytes d) None of these

95. This hormone affects opening and closing of stomata.
a) Zeatin b) Abscisic acid c) Ethylene d) GA

96. Transport of gases, hormones, photosynthetase and organic solutes in plants is
a) Multidirectional
b) Unidirectional
c) In two direction
d) First unidirectional then divides to many direction

97. Fensom and Jones suggested, which of the following method for translocation of solute?
a) Osmosis b) Plasmolysis c) Diffusion d) Electro-osmosis

98. Which statement can be shared by facilitated diffusion and active transport?
a) Both need carrier transporter, which are sensitive to inhibitors that reacts with protein side chains
b) Energy is required by both the processes
c) No energy expenditure in these processes
d) Both use carbohydrates to move molecules across the membrane

99. Which of the following has maximum water potential?
a) Pure water b) 2% sucrose solution
c) 4% glucose solution d) 10% sodium chloride solution

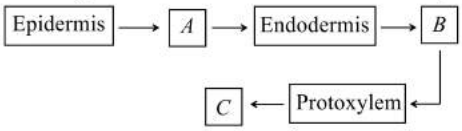
100. In plants, long distance transport of organic and inorganic substances occur through
a) Simple permanent tissues
b) Complex permanent tissues
c) Meristematic tissues
d) Epithelial tissues

101. Xylem sap is made up of
a) Water alone b) Water and minerals c) Minerals alone d) Sugar and water

102. Passive absorption of mineral salts is not dependent on
a) Diffusion b) Osmosis
c) Donnan equilibrium d) Ionic exchange

103. The pressure exerted by the protoplast due to the entry of water against the rigid cell wall is termed as
a) Turgor pressure b) Osmotic potential c) Solute potential d) Water potential

104. In the given schematic diagram, pathway of water movement inside the root is shown from soil to xylem. Identify the tissue involved in the steps *A*-*C* and choose the correct option accordingly




a) A-Hypodermis, B-Medullary rays, C-Metaxylem
b) A-Cortex, B-Pericycle, C-Metaxylem
c) A-Pericycle, B-Cortex, C-Metaxylem
d) A-Hypodermis, B-Cortex, C-Vascular tissues

105. Some statements are given regarding the active transport in plants. Choose the incorrect statement
a) Active transport need energy to pump molecules against the concentration gradient
b) It is carried out with the help of membrane protein
c) Due to more concentration of charged particles in soil then the concentration in roots, active absorption of mineral takes place
d) All of the above

106. Root endodermis has the ability to actively transport ions ...A... because of ...B... .
Choose the correct pair
a) A-bidirectionally; B-plasmodesmata
b) A-undirectionally; B-casparion strips
c) A-undirectionally; B-plasmalemma
d) A-bidirectionally; B-casparion strips

107. The shape of guard cells in stomata in sugarcane plant is
a) Dumb bell-shaped b) Bean shaped c) Horse shoe shaped d) Irregular shaped

108. Plants develops force for upward conduction of water against gravity is derived from
a) Photosynthesis process
b) Transpiration
c) Root pressure
d) Both (b) and (c)

109. How translocation of organic material is explained in plants?
a) By transpiration pull/cohesion adhesion theory
b) Imbibition theory
c) Mass flow hypothesis
d) Root pressure theory

110. Two cell (A and B) have osmotic potential and pressure potential – 18 bars and 8 bars, and – 14 bars and 2 bars respectively. What will be the direction of water flow?
a) From cell A to cell B
b) Flow of water does not takes place
c) In both direction
d) From cell B to cell A

111. Which one of the following acts as a barrier in a apoplastic pathway?
a) Epidermis b) Plasmodesmata c) Casparian strips d) Metaxylem

112. Go through the following pairs and choose the correct pairs from the option given below

| | | |
|---|---|---|
| I. *Nerium* | Sunken stomata | lower epidermis of leaves to reduces loss of water |
| II. *Calotropis* | Non-succulent | Root cells with thickened cell walls |
| III. *Peperomia* | Leaf succulent | Leaf epidermal cell, store water |
| IV. *Ammophila* | Dicot | Curl their leaves to minimise loss of water |
| V. *Tribulus* | Ephemeral | Water is stored in stem |

a) All pairs are correct
b) I, II and III are correct pairs
c) IV and V pairs are correct
d) I, IV and V are correct pairs only

113. Which pathway applies least resistance to the movement of water?
a) Apoplast pathway
b) Symplast pathway
c) Trans membrane pathway
d) Vacuolar pathway

114. Examples of bulk flow by a positive hydrostatic pressure gradient and a negative hydrostatic pressure gradient are
a) Suction through straw and swelling of wood, respectively
b) Imbibition and a garden hose
c) Garden hose and suction through a straw, respectively
d) Swelling of wood and imbibition, respectively

115. During flowering, fruit ripening and development period in plants, which part of the plant act as source?
a) Whole plant
b) Stem and leaves and the plant
c) Photosynthesising leaves and older leaves
d) Growing parts of the plants

116. Plants growing on hills are likely to show
a) Higher rates of transpiration
b) Lower rates of transpiration
c) Same rate of transpiration as in plains
d) Lower rates of transpiration provided the stomata are sunken

117. The transport of ions up the stem to all parts is through
a) Transpiration stream b) Mass flow c) Diffusion d) None of these

118. How much of absorbed water is lost during transpiration in a plant?
a) 99% b) 98-99% c) 99.9% d) 90-95%

119. Which one of the following is part of symplast?
a) Cytoplasm b) Protoplast c) Plasmodesmata d) All of these

120. The real forces responsible for the movement of water from one cell to another cell is mainly
a) Osmotic pressure b) Turgor pressure
c) Diffusion pressure deficit d) Imbibitions

121. Water occur freely in previous rocks and deep in soil above the impermeable strata is
a) Ground water b) Soil water c) Deep stratum water d) Hygroscopic water

122. A twig kept in water having some salt remains fresh for longer period due to
a) Decrease in bacterial degradation b) Exosmosis
c) Decrease in transpiration rate d) Absorption of more water

123. If stem of plant is cut under a state of tension in xylem sap, what will be the result?
a) The xylem sap sprout out b) Xylem sap will accumulate at cut surface
c) The cut surface will form air bubbles, when placed in water d) Air will be pulled into the xylem

124. One factor responsible for water rise up to 100 m of tall plant, is
a) Root pressure b) Transpiration pull c) Pulsation d) Diffusion

125. Read carefully the following statements and choose the right answer from the options given below
I. Diffusion is a slow process and it do not depends upon the living system
II. Usually process of diffusion does not need energy
III. Diffusion can occur from one part of a cell to another part of the same cell or from one cell to another and from one tissue to another tissue
IV. Diffusion is a rapid process over short distance, but extremely slow over long distances
a) I and III b) I and II c) III and IV d) I, II, III and IV

126. Tension, one of the important factor in the movement of xylem sap in a tree is a result of

a) Cohesive nature of water
b) Capillary size of xylem tube
c) Transpiration at the leaf surface
d) All at the above

127. What is the approximate dry weight contained by majority of herbaceous plants?
a) Ground 50% of fresh weight
b) 31% of fresh weight
c) About 10-15% of fresh weight
d) Exactly 29% of dry weight

128. Root hair absorb water from the soil on account of
a) Turgor pressure
b) Osmotic pressure
c) Suction pressure
d) Root pressure

129. The space between the plasma membrane and the cell wall of a plasmolyzed cell surrounded by a hypertonic solution is occupied by the
a) Hypotonic solution
b) Isotonic solution
c) Hypertonic solution
d) Water

130. The first process by which water enters into the seed coat when a seed is placed in suitable environment for germination is
a) Osmosis
b) Active transport
c) Absorption
d) Imbibitions

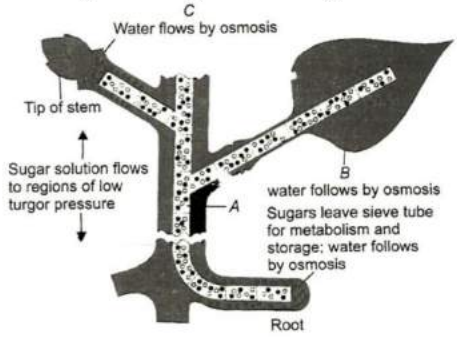
131. The osmotic potential and pressure potential of three cells (A, B, C) located in different parts of an actively transpiring plant are given below.

| Cell | Osmotic Potential (MPa) | Pressure Potential (MPa) |
|---|---|---|
| A | -0.87 | 0.44 |
| B | -0.92 | 0.34 |
| C | -0.68 | 0.27 |

Identify these three cells as root hair, root cortical and leaf mesophyll cells respectively. The correct answer is
a) A, B, C
b) A, C, B
c) C, A, B
d) B, C,A

132. In tall plants, because of which factor, continuous water column extends upward?
a) Atmospheric pressure
b) Osmotic pressure
c) Suction pull
d) Root pressure

133. In the given diagram identify the marked phenomenon/part and choose the correct option accordingly




a) A-Phloem, B-Sugar leaves sieve tube, C-Sugar enters sieve tube
b) A-Xylem, B-Sugars leaves sieve tube, C-Sugar enters sieve tube
c) A-Phloem, B-Sugar enters sieve tube, C-Sugars leaves sieve tube
d) A-Xylem, B-Sugar enters sieve tube, C-Sugars leaves sieve tube

134. What will happen, if a large amount of water enters in a plant cell?
a) TP of cell gets reduced
b) TP opposes the entry of water
c) Water potential of the cell become more negative
d) Water potential of the cell increases simultaneously

135. Identify true and false statements and select the correct option from the codes given below
I. As suction pressure increases, water absorption also increases which in turn increases the absorption of ions

II. Absorption of ions is affected by transpiration pull
III. Large amount of charged particles are absorbed along with absorption of water
IV. Pressure flow hypothesis depends entirely on the existence of mechanism for loading sugars into phloem at the source region and unloading it at the sink
V. Contents in the sieve tube move undirectionally

a) I, II, III and IV are true while V as false
b) I, III, IV and are true while II is false
c) I, II, IV and V are true while III is false
d) II, III, IV and V are true while I is false

136. Opening of stomata is not affected by

a) $N_2$
b) $K^+$ ions
c) Starch
d) None of these

137. Osmosis involves flow of

a) Water without a membrane
b) Solute from a semi-permeable membrane
c) Solvent ($H_2O$) through a semi-permeable membrane
d) None of the above

138. Cohesion force, a feature of cohesion theory is also called

a) Tensile a strength
b) Surface tension
c) Mutual force
d) Transpiration pull

139. A plant cell becomes turgid due to

a) Plasmolysis
b) Exosmosis
c) Endosmosis
d) Electrolysis

140. Which of the following experiments is called physiological demonstration of osmosis?

a) Thistle funnel, whose mouth is tied with egg membrane
b) Thistle funnel, whose mouth is tied with parchment paper
c) Photometer
d) Bell jar experiment

141. Which of the following statements is/are true?

I.The apoplastic movement of water occurs exclusively through the cell wall without crossing any membranes.
II.Solutes present in a cell (or in any solution) increase the free energy of water or water potential.
III.The symplastic movement occurs from cell to cell through the plasmodesmata.
IV.Membrane permeability depends on the membrane composition, as well the chemical nature of the solute.

a) I and II only
b) II and Iv only
c) I, III and IV only
d) I, II and IV only

142. Which of the following maintains the shape of cell?

a) Osmotic pressure
b) Turgor pressure
c) Wall pressure
d) Osmosis

143. Consider the following statements and choose the correct answer

I. Carrier proteins are needed by both facilitated diffusion and active transport and are sensitive to inhibitors that react with protein side chain
II. Different types of proteins present in the membrane plays a major role in both active as well as passive transport
III. The carrier proteins needed by facilitated and active transport are specific
IV. There is no need of energy to pump molecule against a concentration in active transport
V. Transport rate reaches to saturation point, when all the active proteins are used

a) I, II, II, IV and V
b) I, II and III
c) V, IV and I
d) I, II, III and V

144. Root hair absorbs water from soil through

a) Turgor pressure
b) Ion exchange
c) Osmosis
d) DPD

145. Which type of soil has least water retaining capacity?

a) Sandy soil
b) Black or alluvial soil
c) Laterite soil
d) Loan soil

146. Phloem sap is mainly ..... and ..... . Choose the correct pair of options?
a) Water, sucrose b) Sugars, water c) Sucrose, sugars d) Amino acids, sugars

147. Passive absorption of water by the root system is the result of
a) Forces created in the cells of the root
b) Increased respiratory activity in root cells
c) Tension on the cell sap due to transpiration
d) Osmotic force in the shoot system

148. The rate if diffusion is dependent upon the permeability of the medium, it however
a) Influences the final equilibrium of diffusion as it is never reached if the medium is dense
b) Does influence the final equilibrium of diffusion
c) Does not influence the final equilibrium of diffusion
d) None of the above

149. If flowers are cut and dipped in dilute NaCl solution, then
a) Transpiration is low
b) Endosmosis occurs
c) No bacterial growth takes place
d) Absorption of solute inside flower cell takes place

150. Munch hypothesis is based on
a) Translocation of food due to TP gradient and imbibition force
b) Translocation of food due to turgor pressure (TP) gradient
c) Translocation of food due to imbibition force
d) None of the above

151. Study the following table showing the components of water potential in closely arranged mesophyll cells namely A, B and C.

| Cell | Osmotic Potential (MPa) | Pressure Potential (MPa) |
|---|---|---|
| A | -0.21 | 0.05 |
| B | -0.22 | 0.02 |
| C | -0.23 | 0.05 |

Identify two of the following, which show correct direction of water movement between two cells.

I A→B II B→C
III C→A IV C→B

a) I, II b) II, III c) I, IV d) II, IV

152. Transpiration facilitates
a) Electrolyte balance
b) Opening of stomata
c) Absorption of water by roots
d) Exertion of minerals

153. Which of the following is not correct regarding carrier molecules, involved in facilitated diffusion?
a) They are responsible to concentrate solute molecules on the side of membrane
b) They are responsible to increase the speed of transport across a membrane
c) They may be under conformational change upon binding of solutes
d) They possess specific binding sites for molecules to be transported

154. Which of the following is used as an antitranspirant?
a) Cobalt chloride
b) Naphthol acetic acid
c) Calcium carbonate
d) Phenyl mercuric acetate

155. Study the following statements
I. Most minerals must enter the roots by active absorption into cytoplasm and epidermal cells
II. Ions are absorbed by both passive and active transport
III. Active absorption does not require energy

IV. Active uptake of ions is responsible for osmosis

Choose the correct option in reference to the statements given above

a) I and II are correct and III and IV are incorrect
b) I, II and IV are correct and III is incorrect
c) I, II, III and IV
d) I, III and II are correct IV is incorrect

156. Arrange the following events of mass flow of organic material in sequence

I. Sugars are transported from cell to cell in the leaf
II. Food is synthesised in form of glucose by leaf cells
III. Movement of water takes place into sieve tube elements
IV. Downward movement of sugar occurs in the stem
V. Solutes are actively transported into the sieve elements

a) I, II, III, V, IV
b) II, I, V, III, IV
c) II, III, I, V, IV
d) I, II, V, IV, III

157. Which of the following lacks stomata?

a) Aquatic plants with floating leaves
b) Xerophytes
c) Aquatic submerged plants
d) Sciophytes

158. Guard cells control

a) Intensity of light entering
b) Photosynthesis
c) Closing and opening of stomata
d) Change in green color

159. Wilting occurs when

a) Rate of transpiration is higher than absorption
b) Rate of absorption is higher than transpiration
c) Excess root pressure
d) High relative humidity in air

160. Which among the following represents the correct relationship for a plasmolysed cell?

a) $\Psi_W = \Psi_S + \Psi_P$
b) $\Psi_S = \Psi_W + \Psi_P$
c) $\Psi_W = \Psi_S$
d) $\Psi_W = \Psi_P$

161. Water in the soil available to plants is

a) Gravitational water
b) Capillary water
c) Hygroscopic water
d) None of these

162. If two types of seeds, like pea and maize are kept in water at the same time. Which among the two will imbibe more water?

a) Maize seed
b) Pea seed
c) Both imbibe equal amount of water
d) Pea seed imbibe more water only at alkaline pH

163. The magnitude of root pressure ranges between

a) 2-5 atm
b) 1-5 atm
c) 0.1-0.2 atm
d) 4-6 atm

164. Read the following statements regarding porins and select the correct option given below

I. Porins are transport proteins
II. Channel proteins are a type of transport protein, which are usually gated
III. Carrier protein binds the particular solute to be transported
IV. Particular solute is delivered to the other side of the membrane by carrier proteins

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

165. RBC and a plant cell (with thick cell wall) are placed in distilled water. The solute concentration is the same in both the cells. What changes would be observed in them?

a) Both plant cell and RBC would not undergo any change
b) The RBC would increase in size and burst, while the plant cell would remain about the same size
c) The plant cell would increase in size and burst, while the RBC would remain about the same size
d) Both plant cell and RBC would decrease in size and collapse

166. Osmotic pressure is highest in which of the following plant type?
a) Mesophytes b) Xerophytes c) Halophytes d) Hydrophytes

167. When a cell is plasmolysed, it becomes
a) Flaccid and its TP becomes zero
b) Turgid and its becomes zero
c) Turgid and TP becomes equal to OP
d) Flaccid and DPD becomes zero

168. Water is lost in a liquid state in some plants through hydathodes. These hydathodes
a) Remain closed at night
b) Remain closed during day
c) Remain always open
d) Do not show any specificity in opening and closing

169. Cell-A has osmotic potential of -18 bars and pressure potential of 8 bars, whereas, cell-B has osmotic potential of -14 bars and pressure potential 2 bars. The direction of flow of water will be
a) From cell-B to cell-A
b) From cell-A to cell-B
c) No flow of water
d) In both the directions

170. Which type of transpiration continues throughout day and night?
a) Cuticular transpiration
b) Lenticular transpiration
c) Bark transpiration
d) All of these

171. The first process responsible for the entry of water into a seed, when it is placed in a suitable environment for germination is
a) Absorption
b) Imbibition
c) Active transport
d) Osmosis and diffusion

172. Read the given statements regarding the different stages of plasmolysis and choose the correct option
I. First stage of plasmolysis, when osmotic concentration of cell sap is just equivalent to that of external solution
II. Protoplast withdraws itself from corners of the cell wall
III. Protoplast gets detached from the cell wall and attains a spherical shape

| | I | II | III |
|---|---|---|---|
| a) | Incipient plasmolysis | Limiting plasmolysis | Evident plasmolysis |
| b) | Limiting plasmolysis | Incipient plasmolysis | Evident plasmolysis |
| c) | Limiting plasmolysis | Evident plasmolysis | Incipient plasmolysis |
| d) | Evident plasmolysis | Incipient plasmolysis | Limiting plasmolysis |

173. Water composition in a water-melon is approximately
a) 95% b) 97% c) 90% d) 92%

174. The membrane, which allows passage of certain substances more readily than others is termed as
a) Permeable
b) Selectively permeable
c) Semi-permeable
d) Impermeable

175. Which one of the following is not a part of symplast?
a) Cell wall
b) Plasma membrane
c) Plasmodesmata
d) Cytoplasm

176. What is mandatory in the process of facilitated diffusion?
a) Presence of concentration gradient
b) A carrier protein
c) A hydrophilic moeity
d) All of the above

177. A special type, which occurs when water is absorbed by solids causing them to increase in volume is called
a) Osmosis b) Translocation c) Imbibition d) Transpiration

178. Which of the following does not affect water potential of water?
a) Concentration of dissolved substances
b) Atmospheric pressure
c) Gravitation
d) Capillarity

179. Study the following pairs.

| | | |
|---|---|---|
| VI. Peperomia | Leaf succulent | Leaf epidermal cells store water. |
| VII. Calotropsis | Non-succulent | Root cells with thickend cell walls. |
| VIII. Tribulus | Ephermeral | Stem stores water. |
| IX. Ammophila | Dicot plant | Rolling in of leaves to check water loss |

Identify the correct pair of answer.
a) I, II
b) I, III
c) II, III
d) II, IV

180. Consider the following statements and choose the correct option from codes given below
I. Loading of phloem is related to increase of sugar in phloem
II. Active loading of sugar in sieve tube of phloem is driven by proton pump
III. Pressure may be positive or negative in sieve tube cells
IV. Water and solutes move through the sieve tube against pressure gradient
V. Cytoplasmic strand passes through the holes in sieve plates and form continuous filaments
a) I, II, V are incorrect, while III and IV are correct
b) III and IV are incorrect while I, II and V are correct
c) I, II and III are incorrect while IV and V are correct
d) IV and V are incorrect while, I, II and III are correct

181. Path of water movement from soil to xylem is
a) Soil→root hair→cortex→ pericycle → endodermis →metaxylem→protoxylem
b) soil→root hair→cortex→endodrmis→pericycle→protoxylem→metaxylem
c) soil→root hair→epidermis→endodermis→phloem→xylem
d) soil→root hair→epidermis→cortex→phloem→xylem

182. The stomata in CAM plants open during
a) Day
b) Night
c) Day and night
d) Always closed

183. What will be the affect of accumulation of potassium ions in guard cells?
a) Decrease in turgor pressure
b) Exosmosis
c) Increase in water potential
d) Decrease in water potential

184. Through which process, starch of the guard cell is converted into PEP ions?
a) Dephosphorylation
b) Decarboxylation
c) Hydrolysis
d) Oxidation

185. Which one of the following does not help in molecular transport?
a) Diffusion
b) Osmosis
c) Surface tension
d) Active transport

186. Ascent of sap is
a) Active and requires energy expenditure by the soil
b) Passive, and no requirement of energy by the plants
c) Active and requires energy expenditure by the plants
d) Passive unless soil is dry

187. Passage cells are thin-walled cells found in
a) Endodermis of roots facilitating rapid transport of water from cortex to pericycle
b) Phloem elements that serve as entry points for substances for transport to other plant parts
c) Testa of seeds to enable emergence of growing embryonic axis during seed germination
d) Central region of style through which the pollen tube grow towards the ovary

188. The term apoplast signifies
a) Cell wall, intercellular space and water filled channel
b) Protoplasts inter connected by plasmodesmata
c) Cell wall, cytoplasm and central vacuole
d) None of the above

189. Select the correct option in reference with the statements given below
I. Facilitated diffusion cannot cause net transport
II. Transport rate in case of facilitated diffusion never reaches to a maximum level
III. Facilitated transport is selective to inhibition proteins
IV. Concentration gradient is not required in case of facilitated diffusion
a) II and IV b) I, II, III and IV c) I and III d) None of these

190. Osmotic pressure of a solution is
a) Greater than pure solvent b) Less than pure solvent
c) Equal to pure solvent d) Less than or greater than pure solvent

191. Potometer works on the principle of
a) Amount of water absorbed equals the amount transpired
b) Osmotic pressure
c) Root pressure
d) Potential difference between the tip of the tube and that of the plant

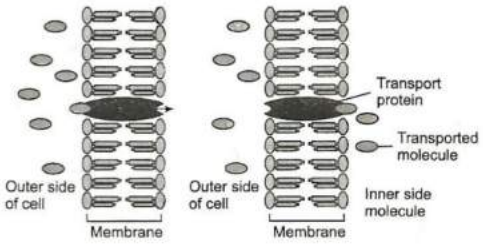
192. In which of the following path, flow of water occurs from cell to cell through their protoplasm?
a) Apoplast pathway b) Symplast pathway
c) Both (a) and (b) d) Transmembrane pathway

193. Transport of minerals through xylem is
a) Active and energy is provided by ATP b) Passive and no energy is provided
c) Active and no requirement of energy d) Passive and energy is provided by ATP

194. Mechanism of opening and closing of stomata is controlled by
a) Guard cells b) Accesary cells c) Epidermal cells d) None of these

195. Stomata are also called as
a) Stomates b) Lenticels c) Hydathodes d) Bark

196. Identify the following process and choose the correct option




a) Simple diffusion b) Facilitated diffusion c) Osmosis d) Deplasmolysis

197. The diagram given below represents the simple ringing or girdling experiment. Bark containing phloem is removed. This experiment proves and justify that phloem is the path for translocation of food. In the given diagram, swollen part of stem has been indicated. What is cause of swollen part?


Choose the correct option
a) Accumulation of food material just above the ringing space
b) Accumulation of minerals and water just above the ringing space
c) A repairing mechanism is taken
d) Injured part undergo turgor change

198. Hydathodes are also called
a) Water stomata b) Sunken stomata c) Guard cells d) Subsidiary cells

199. What happens when concentration of solutes decreases in guard cells?
a) Water potential increases
b) Osmotic pressure increases
c) Water potential decreases
d) None of the above

200. During water absorption from the soil, the water potential of the root cell is.....than the soil
a) Higher
b) Lower
c) Slightly higher
d) Slightly lower

201. Water potential gradient can be best defined as
a) Pressure gradient minus water potential
b) The overall movement of water
c) Evaporation of water from stem and leaves
d) The overall movement of solutes

202. Humidity in atmosphere decreases rate of
a) Transpiration
b) Photosynthesis
c) Glycolysis
d) Growth

203. Guard cells help in
a) Protection against grazing
b) Transpiration
c) Guttation
d) Fighting against infection

204. Both minerals and water are absorbed by
a) Zone of elongation in root
b) Growing point in root
c) Root hair zone
d) Zone of mature cells

205. Fensom and Jones suggested which of the following method for translocation of solute?
a) Osmosis
b) Plasmolysis
c) Diffusion
d) Electrosmosis

206. Mycorrhiza, a mutal relationship between fungus and a root of gymnosperm helps in
I. absorption of water
II. mineral absorption
III. translocation
IV. gaseous exchange
Choose the correct option
a) Only I
b) II and I
c) III and IV
d) Only II

207. Which of the following pair is selective and specific mode of transport?
a) Passive transport and active transport
b) Passive transport and facilitated diffusion
c) Facilitated diffusion and active transport
d) Simple diffusion and facilitated diffusion

208. Consider the following statements and choose the correct answer from the options given below
I. A dry live seed still contains water
II. A mature maize plant absorbs about 3 L water per day
III. A mustard plant take up water equal to its weight in about five hours
IV. Water is not considered as the limiting factor for plant growth and productivity
a) I, II, III and IV
b) IV and II
c) I, II and III
d) Only IV

209. Which one is true about guttation?
a) It occurs through specialized pores called hydathodes
b) It occurs in herbaceous plants when root pressure is low and transpiration is high
c) It only occur during the day time
d) It occurs in plants growing under conditions of low soil moisture and high humidity

210. What are the location of casparian strips-which interrupts the movement of water inside a root?
a) Endodermis
b) Pericycle
c) Cortex
d) Hypodermis

211. Select the correct statement from the following

a) Only the net direction of osmosis, not the rate of osmosis depends on both the pressure gradient and concentration gradient
b) The rate of osmosis depends only on pressure gradient
c) The net direction and rate of osmosis depends upon both the pressure gradient and concentration gradient
d) The net direction and rate of osmosis do not depend on the pressure gradient and concentration gradient

212. Which one of the following doesn't help in molecule transport?
a) Diffusion b) Osmosis c) Surface tension d) Active transport

213. What type of material do not diffuse or find it difficult to pass through the membranes?
a) Hydrophobic substance
b) Hydrophilic substances
c) Inorganic solute
d) Both hydrophilic and hydrophobic substances

214. When the concentration of the soil solutes is low, the absorption of water
a) Remains normal b) Is stopped c) Is increased d) Is decreased

215. If sugars are actively moving into a cell, what will happens to the turgor pressure of the cell?
a) TP increases, due to the entry of water
b) TP decreases because water exits
c) TP increases as sugar concentration affects it directly
d) No effect of sugar concentration of furgidity hence no change

216. Read the following statements and choose the correct answer from the options given below
a) In the absence of casparian strips, plants are unable to control amount of water and solute it absorbs
b) Guttation is generally occur during low atmospheric humidity and plentiful soil water
c) Role of $Na^+$ in stomatal opening is universally accepted
d) In CAM, plant stomatal remains open in day and night

217. Movement among cells against concentration gradient is called
a) Osmosis b) Active transport c) Diffusion d) Passive transport

218. Transport proteins of endodermal cells are ...A... where a plant adjusts the ...B... and ...C... of solutes that reaches the ...D...
Choose the correct combination of A-D from the given options
a) A-control points, B-ratio, C-type, D-xylem
b) A-regulators, B-quantity, C-type, D-phloem
c) A-control points, B-quantity, C-type, D-xylem
d) A-regulators, B-quantity, C-size, D-phloem

219. Select the correct events leading to the opening of the stomata.
I.Decline in guard cell solutes.
II.Lowering of osmotic potential of guard cells.
III.Rise in potassium levels in guard cells.
IV.Movement of water from neighbouring cells into guard cells.
V.Guard cells becoming flaccid.
a) I and V b) II, III and IV c) I, III and IV d) II, IV and V

220. Choose, true and false statements from the following and select the correct option from the set (a-d) given below
I. Diffusion is an important process of transport in plants since it is the only means for gaseous movement within the plant body
II. In active transport, pumps are proteins that use energy to carry substance across the cell membrane against concentration gradient

III. In facilitated diffusion, special proteins helps hydrophilic substances to be transported across the membrane
IV. In diffusion, molecules move against concentration gradient in a random manner
V. Facilitated diffusion is faster than active transport
a) I, II, III and IV
b) I, II, III are true, while IV and V are false
c) IV and V are true, while I, II and III are false
d) Only II, III, IV are true while I and V are false

221. Which one of the following is the most accepted theory of ascent of sap?
a) Root pressure theory
b) Root pressure theory
c) Passive transport
d) Cohesion theory

222. At the time of seed germination, when water is absorbed by the seed due to imbibition, the seed coat breaks as it swells to a lesser degree than the kernel because
a) The kernel is made up of cellulose while the seed coat is made up of proteins lipids and starch
b) The kernel is made up of proteins, lipids and starch, while the seed coat is formed of cellulose
c) Both kernel and seed coat are made up of same constituents, it depends on the nature of medium
d) None of the above

223. Unloading of minerals occur at
a) Apical meristem
b) Fine vein ending
c) Fruits
d) All of these

224. Why the tropical deciduous forest trees shed their leaves?
a) To save energy
b) To protect itself from chat
c) To enhance rate of respiration
d) To prevent loss of water

225. Which of the following affects the rate of diffusion?
a) Concentration gradient
b) Permeability of the membrane
c) Temperature and pressure
d) All of the above

226. A student has taken a twig from a plant. She/he observe a droplet of fluid exuding from the cut surface of twing. What is this fluid?
a) Plant latex
b) Phloem sap
c) Xylem sap
d) Both (b) and (c)

227. The translocation of organic solutes in sieve tube members is supported by
a) Root pressure and transpiration pull
b) P-proteins
c) Mass-flow involving a carrier and ATP
d) Cytoplasmic streaming

228. Active transport
a) Releases energy
b) Requires energy
c) Produces ATP
d) Produces a toxic substance

229. Some cells are placed in a solution of glucose to measure the rate of diffusion. As the concentration of glucose solution is being increased, the diffusion rate increases simultaneously. However, when the concentration of glucose solution reaches above 10 m, the diffusion rate no longer increases
Which statement best define the mechanism of glucoses transport in the cells?
a) Transport of hydrophilic substances along the concentration gradient through fixed membrane transport protein without the involvement of energy expenditure
b) Transport of hydrophilic substances along and against the concentration gradient *via* carrier proteins
c) Active transport *via* transporter proteins
d) Facilitated diffusion without carrier proteins

230. The plants, which are able to send their roots up to the fringe of water table are called
a) Xerophytic plants
b) Terrestrial plants
c) Phreatophytes
d) Mesophytes

231. Transport of different types of solute substances takes place by
a) Bulk flow system
b) Combind response
c) Facilitated diffusion
d) Pressured transport

232. Phloem sap is made up of
a) Water and minerals
b) Water and sucrose
c) Water and glucose
d) Both (b) and (c)

233. Which of the following affect the transport of molecules when carrier mediated facilitated diffusion is involved?
a) Solubility of molecule in lipids
b) Concentration gradient

c) Availability of carrier molecule
d) All of the above

234. Who coined the term diffusion pressure deficit?
a) Slatyer
b) Taylor
c) Meyer
d) Slatyer and Taylor

235. Which one of the following does not play a major role in upward movement of xylem sap in tall trees?
a) Transpiration
b) Tension
c) Cohesion and Adhesion
d) Plasmodesmata

236. Why the rate of diffusion of a substance along the concentration gradient does not increase continuously, while the concentration difference of the molecules across the membrane increases?
a) Process of facilitated diffusion need ATP
b) As concentration difference increases, molecule interfere with one another
c) 100% saturation of carrier protein after some time
d) Transport proteins must be of channel protein type

237. Which of them is/are correct regarding pressure flow model for translocation?
I. Sugar is transported through phloem as glucose
II. Movement of sugar is carried out through sieve tube near the source region
III. Concentration of sugar is always highest near the sink region
IV. Water from the adjacent xylem moves into phloem by osmosis
a) II and IV
b) II and III
c) I, II and III
d) Only IV

238. After heavy rain fall with poor drainage, laves of many plants wilt due to
a) Root rot
b) Poor aeration
c) High salt concentration
d) Low soil temperature

239. Graham's law is correlated with
a) Diffusion
b) Osmoregupation
c) Osmosis
d) Absorption

240. Who proposed the 'Cohesion Theory' of ascent of sap?
a) Strasburger
b) Godlewski
c) Western
d) Dixon andJolly

241. Which of the following statements is/are not true?
I.In CAM plants, stomata open during dark and remain closed during the day.
II.Role of $Na^+$ in stomatal opening is now universally accepted.
III.The water potential of root cells is higher than the water potential of soil.
IV.Capillarity theory is the most accepted theory of water movement through plants.
V.The walls of xylem vessels made up of lingo-cellulose have strong affinity for water molecules.
a) II, III and V
b) II, III and IV
c) I, II and III
d) II and III

242. How would you differentiate between apoplast and symplast?
a) Apoplast relies on active transport
b) Symplast deals in non-living spaces and cell walls
c) Apoplast prevents passive diffusion
d) Apoplasts deals in non-living spaces and cell walls

243. Water potential of a solution is denoted by
a) $\Psi_X$
b) $\Psi_P$
c) $\Delta_\Psi$
d) $\Psi_w$

244. Which one of the following statements is wrong?
a) Water potential is the chemical potential of the water
b) Solute potential is always negative
c) Pressure potential is zero in a flaccid cell
d) Water potential equals solute potential in a fully turgid cell

245. Cell wall present in water conducting tissues, represented by swollen nodules, is known as
a) Tertiary wall
b) Middle lamella
c) Plasmalemma
d) Primary cell wall

246. Transport of organic solutes is supposed to take place by pressure flow hypothesis through phloem tissue from source to sink. Choose the false statement about vascular tissue transport
   a) Phloem transport mainly water and sucrose but other sugars, hormone and aminoacids are also transported
   b) Water enters into the sieve tube by the process of osmosis
   c) Water and solute move through the sieve tube along the pressure gradient
   d) Sieve tube in the source have a low turgor pressure (pressure potential)

247. How much percentage of absorbed water in plants is used in the process of photosynthesis?
   a) Around 0.2%
   b) Less than 1% of absorbed water
   c) 1% of absorbed water
   d) 1-2% of absorbed water

248. The force responsible for upward conduction of water against gravity comes from
   a) Transpiration
   b) Photosynthesis
   c) Translocation
   d) Respiration

249. Which of the following is not a purpose of transpiration?
   a) Supplies water for photosynthesis
   b) Helps in translocation of sugars from source to sink
   c) Maintains shape and structure of the plant
   d) Cools leaf surface

250. A soil sample is found to have 25% of its volume occupied by soil water. Of this, 10% is hygroscopic water and the remaining is capillary water. What is the field capacity of this soil?
   a) 10%
   b) 15%
   c) 25%
   d) 35%

251. Why is active transport considered important?
   a) Because material is transported from higher concentration to lower concentration
   b) Because material is transported from lower concentration to higher concentration
   c) Because it increases diffusion coefficient
   d) Because it does not use ATP

252. In mycorrhizal association, which one of the following increases the surface area available for absorption of water and minerals by roots?
   a) Mycorrhiza
   b) Numerous branches of root
   c) Root hairs
   d) None of the above

253. Uphill transport is a type of
   a) Active transport
   b) Passive transport
   c) Facilitated diffusion
   d) Simple diffusion

254. Compare the following processes of transport and choose the correct option

| S. No. | Property | Facilitated Diffusion | Active Transport | Simple Diffusion |
|---|---|---|---|---|
| I. | Highly specific | Yes it is selective | Yes | No |
| II. | Energy as ATP | Yes | Yes | Yes |
| III. | Saturation point is attached when all carrier protein are | Yes | No | Yes |

| | | | | |
|---|---|---|---|---|
| | being used | | | |
| IV. | Require transport proteins | Yes | No | Yes |

a) Only II
b) Only III
c) I, II, III and IV
d) Only I

255. Ascent of sap in plants was demonstrated by
a) Girdling experiment
b) Ganong's experiment
c) Went experiment
d) Lever auxanometer

256. The value of pure water potential is
a) Always positive or more than zero
b) Always negative or less than zero
c) Always zero
d) Variable in different solution

257. Loss of water in liquid phase (in form of droplets) from the margin of leaves in many herbaceous plants is
a) Guttation
b) Root pressure
c) Transpiration
d) Transpiration pull

258. The relationship among different types of soil water can be summed up of the following equation:
a) Chresard=Echard+Hollard
b) Chresard=Hollard+Echard
c) Echard=Hollard+Chresard
d) Hollard= Chresard–Echard

259. A cell dipped in 0.5 M sucrose solution has no effect but when the same will be dipped in 0.5 M NaCl solution, the cell will
a) Increase in size
b) Decrease in size
c) Will be turgid
d) Will get deplasmolysed

260. Transpiration is manifestation of
a) Turgor pressure
b) Wall pressure
c) Root pressure
d) None of these

261. Two cells A and B are contiguous. Cell-A has osmotic pressure-10 atm, turgor pressure-7 atm and diffusion pressure deficit-3 atm. Cell-B has osmotic pressure-8 atm, turgor pressure-3 atm and diffusion pressure deficit 5 atm. The result will be
a) Movement of water from cell-B to A
b) No movement of water
c) Equilibrium between the two
d) Movement of water from cell-A to B

262. Plasmolysis is the result of
a) Exosmosis
b) Endosmosis
c) Reverse osmosis
d) Diffusion

263. Stomata open and close due to
a) Turgor pressure change
b) Hormonal change
c) Temperature change
d) All of these

264. Which one is incorrect statement?
a) Movement of water is expressed in terms of free energy
b) Free energy determines the direction by which physical and chemical changes should occur
c) Water potential is the sum of free energy of water molecules in pure water and in any other system
d) Water potential of pure water is zero

265. Which of the following is appropriate for mass-flow hypothesis?
a) Transpiration pull is responsible for absorption of ions
b) Large amount of ions are also absorbed along with the absorption of water
c) As suction pressure increases, absorption of water increases and along with water, absorption of ion also increases
d) All of the above

266. The antitranspirant is
a) PMA b) ABA c) Both (A) and (B) d) None of these

267. The rupture and fractionation do not usually occur in the water column in vessles/tracheids during the ascent of sap because of
a) Lignified thick walls b) Cohesion and adhesion
c) Wak gravitational pull d) Transpiration pull

268. The rate of diffusion of any substance is not affected by
a) Electrical charges of diffusing substances
b) Presence of other substances in the solution
c) Molecular size of substances in a solution
d) Solubility to diffusing substance in lipids

269. Cohension and adhension theory, is otherwise called
a) Relay pump theory b) Pulsation theory
c) Root pressure theory d) Transpiration pull theory

270. Stomata open due to accumulation of
a) $K^+$ b) $Na^+$ c) $Mg^+$ d) $Ca^{2+}$

271. Which of the following in guard cell is responsible for opening of stomata?
a) Decrease in $CO_2$ concentration and more $H^+$ ion concentration
b) Decrease in $CO_2$ concentration and less $H^+$ ion concentration
c) Increase in $CO_2$ concentration and more $H^+$ ion concentration
d) More free $H^+$ ions and less $Cl^-$ ions

272. Which of the following is the most accepted theory for movement of water through plants?
a) Cohension theory b) Capillarity c) Passive transport d) Root pressure

273. The force responsible for the water movement against gravity even up to a 130 m of tall free comes from
a) Root pressure b) Transpiration pull c) Diffusion pressure d) Pulsation

274. A leaf with more stomata on lower surface belongs to
a) Potato type b) Oat type
c) Apple-mulberry type d) *Nymphaea* type

275. When a plant cell is placed in pure water, it
a) Expands until the osmotic pressure reaches that of water
b) Becomes less turgid until the osmotic potential reaches that of pure water
c) Becomes more turgid until the pressure potential of cell reaches its osmotic potential
d) Becomes more turgid until the osmotic potential reaches that of pure water

276. The loosely arranged non-chlorophyllous parenchyma cells present in lenticels, are called
a) Complementary cells b) Passage cells
c) Water stomata d) Albuminous cells

277. Select the wrong statement regarding membrane channels
a) They are proteins
b) They are usually gated, *i.e.*, may be open or closed
c) All ions pass through the same type of channel
d) They form a huge pore in the outer membrane of plastids, mitochondria and some bacteria

278. A group of students are studying transport of certain type of molecules in a cells and observe that transport slows down when the cells are treated with poison, a chemical, which inhibit energy production. Under normal conditions, the molecules are being studied and it is estimated that molecules probably transported by
a) Osmosis
b) Process of active transport
c) Process of facilitated diffusion
d) Process of simple diffusion

279. In symplast pathway of water movement, water passes from cell to cell, whose cytoplasm are connected through
a) Plasma membrane
b) Plasmodesmata
c) Transmembrane
d) Plasmalemma

280. Select the correct statement
a) Water can be absorbed passively by roots
b) Ions are generally absorbed from soil by both active and passive transport
c) $C_4$ photosynthetic system is evolved for maximising the availability of $CO_2$ and to minimise loss of water
d) All of the above

281. Which ion helps in opening and closing of stomata?
a) $Mn^+$
b) $Mg^{2+}$
c) $Ca^{2+}$
d) $K^+$

282. Which theory is considered best to explain ascent of sap
a) Bulk flow system
b) Transpiration pull
c) Transpiration
d) Root pressure theory

283. Which of the following get accumulated in the vacuoles of guard cells during stomatal opening?
a) Water, calcium and magnesium
b) Starch, potassium and chloride ions
c) Malate, sodium and potassium ions
d) Malate, potassium and chloride ions

284. Transpiration is the manifestation of
a) Root pressure
b) Turgor pressure
c) Wall pressure
d) Suction pressure

285. Which among the following has highest water potential?
a) 1 m salt solution
b) 1 m glucose solution
c) Distilled water
d) Both (a) and (b)

286. Stomatal opening is affected by
a) Nitrogen concentration, carbon dioxide concentration and light
b) Carbon dioxide concentration, temperature and light
c) Nitrogen concentration, light and temperature
d) Carbon dioxide concentration, nitrogen concentration and temperature

287. Stoma opens, when
a) Guard cells swell due to an increase in their water potential
b) Guard cells swell by endosmosis due to influx of hydrogen ions (protons)
c) Guard cells swell by endosmosis due to efflux of potassium ions
d) Guard cells swell due to a decrease in their water potential

288. If solute particles are added in pure water, its diffusion pressure will be
a) Increased
b) Decreased
c) Remain constant
d) Become less than zero

289. A red blood cell (RBC) was kept in a certain solution for few minutes and it got burst. The said solution was
a) Isotonic
b) Concentrated sugar solution
c) Hypertonic
d) Hypotonic

290. The rate of transpiration will be very less in a situation where
a) Ground water is sufficiently available
b) Wind is blowing with a very high velocity
c) Environment is very hot and dry
d) Relative humidity is very high

291. The factor, most important in regulating transpiration, is
a) Temperature
b) Light
c) Wind
d) Relative humidity

292. Wooden doors and logs swells up, and get stuck up during rainy season due to
a) Imbibition b) Endosmosis c) Exosmosis d) Both (a) and (c)

293. If water enters in a cell, the pressure exerted by its swollen protoplast is
a) Turgor pressure b) DPD c) Osmotic pressure d) Imbibition

294. What is the most efficient region of water absorption in roots?
a) Root cap
b) Growing point
c) Zone of elongation
d) Zone of differentiation

295. Regarding root pressure, which one is not correct?
a) It is sufficient to rise water above ground level
b) It is positive in all except the tallest trees
c) It do not act as driving force for the mass flow of sugar
d) It is not able to push water up to small height in the stem

296. Choose the correct statements regarding guttation and pick the correct option from the codes given below
I. It occurs through specialised pore called hydathode
II. Hydathodes can be located on the margin and tips of leaves
III. It occurs in plants growing under condition of low soil moisture and high humidity
IV. It occurs in herbaceous plants when root pressure is low and transpiration is high
a) I and II b) III and IV c) I, II, III and IV d) I, II and IV

297. What is the value of DPD?
a) DPD = TP
b) DPD = OP – SP
c) DPD = OP – WP
d) Equal to wall pressure

298. The transport of organic and inorganic substances in plants over longer distance occurs through vascular tissue by the means of
a) Diffusion
b) Facilitated diffusion
c) Active transport
d) Mass flow

299. Choose the correct statement regarding casparian strips
I. It surrounds pericycle
II. It is made up of legnosuberin
III. It limits the pathway available to water solutes, forcing them to enter the symplast
a) I and III b) I, II and III c) 1 and II d) None of these

300. Translocation of organic materials in plants is explained
a) Active transport
b) Transpiration pull
c) Inhibition theory
d) Mass-flow hypothesis

301. Choose the correct option given below
a) Diffusion needs ATP
b) Diffusion is an active and rapid process
c) Diffusion is rapid over short distance but extremely slow over long distance transport
d) Diffusion is slow over short distance, but rapid over long distance transport

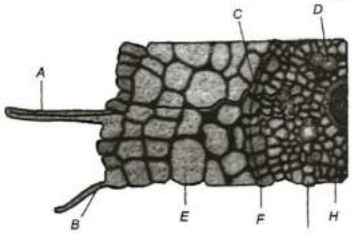
302. Movement of water through cell wall, is
a) Apoplast b) Symplast c) Tonoplast d) None of these

303. Adhesion is caused by
a) Formation of hydrogen bond between water molecules
b) Transpiration pull
c) Higher surface tension
d) Attraction of water molecule to polar surface

304. Short distance transport of substances like nutrients, water etc., in plants occur through
a) Diffusion
b) Cytoplasmic steaming supplemented by active transport

c) Both (a) and (b)
d) Passive transport only

305. A portion of transverse section of root is shown in the diagram. Label A-H in the given diagram and choose the correct option accordingly




a) A-Apoplastic, path; B-Symplastic, path; C-Endodermis; D-Pholem; E-Cortex; F-Casparian strip; G-Pericycle; H-Xylem
b) A-Symplastic, path; B-Apoplastic, path; C-Xylem; D-Pholem; E-Endodermis; F-Cortex; G-Casparian strip; H-Pericycle
c) A-Symplastic, path; B-Apoplastic, path; C-Endodermis; D-Xylem; E-Cortex; F-Casparian strip; G-Pericycle; H-Phloem
d) A- Apoplastic, path; B-Symplastic, path; C-Endodermis; D-Cortex; E-Casparian strip; F-Xylem; G-Phloem; H-Stele

306. With the increase in temperature, the process of imbibition
a) Decreases b) Increases c) Remains the same d) No effect

307. In which form, does the food transported in plants?
a) Sucrose b) Fructose c) Glucose d) Lactose

308. Identify the correct relationship with reference to water potential of a plant cell.
a) $\Psi_w = \Psi_m + \Psi_s + \Psi_p$ b) $\Psi_w = \Psi_m + \Psi_s - \Psi_p$
c) $\Psi_w = \Psi_m - \Psi_s + \Psi_p$ d) $\Psi_w = \Psi_m - \Psi_s - \Psi_p$

309. The correct relationship among different type of soil water is
a) Chresard = Echard + Hollard b) Hollard = Chresard + Echard
c) Echard = Hollard + Chresard d) Hollard = Chresard – Echard

310. In a fully turgid cell
a) TP=0 b) WP=0 c) DPD=0 d) OP=0

311. In which of the following plants, there will be no transpiration?
a) Aquatic, submerged plants b) Plants living in deserts
c) Aquatic plants with floating leaves d) Plants growing in hilly regions

312. The value of osmotic potential of an electrolyte is always
a) More than the electrolyte b) Less than the electrolyte
c) Same as the electrolyte d) None of these

313. Carrier protein, which allows the movement of molecules in opposite direction is
a) Antiport b) Symport c) Both (a) and (b) d) Uniport

314. In osmosis, there is movement of
a) Solute only b) Solvent only c) Both (A) and (B) d) Neither (A) nor (B)

315. If the osmotic pressure of cytoplasm in a cell is balanced by external solution, the solution must be
a) Hypotonic b) Hypertonic c) Atonic d) Isotonic

316. In thistle funnel experiment, what will occur if sugar solution is added to beaker, after the process of osmosis stops?
a) The level of solution in thistle funnel rises up
b) The level of solution in thistle funnel lowers
c) The level of solution in beaker lowers
d) The level of solution remains unaffected in beaker

317. Water rises in the stem due to
a) Cohension and transpirational pull
b) Turgor pressure
c) Osmotic pressure
d) Root absorption

318. Term osmosis is specifically used to refer
a) Diffusion across the semipermeable membrane
b) Diffusion across the permeable membrane
c) Secondary active transport
d) Facilitated diffusion

319. Guttation is mainly due to
a) Root pressure
b) Imbibition
c) Osmosis
d) Transpiration

320. Read the following statement carefully and choose the right answer from the codes given below
I. PMA and silicon oil of low viscosity are considered as antitranspirant
II. BAP, NAA and cobalt chloride is also used as antitranspirant
III. Abscisic acid affects the mechanism of opening and closing of stomata
IV. Starch of guard cells is converted into PEP ions by the process of hydrolysis
V. Potometer works on the principle of potential difference between the tip of the tube and that of plant
VI. Transpiration rate is directly proportional to the relative humidity
a) I, II, III, IV, V and VI
b) I, II, III and IV are correct while V and IV are incorrect
c) V and VI are correct, while, I, VI, III and IV are incorrect
d) I, III, VI are correct, while II, IV, V are correct

321. When pea seeds and wheat grains are soaked in water, pea seeds showed more swelling than the wheat. The reason is
a) Imbibitions capacity of proteins is more than that of starch
b) Presence of less hydrophilic colloids in the wheat grains
c) Cell membrane of pea seeds is more permeable
d) Cell wall of wheat grains are less permeable

322. The phytohormone, which increases the concentration of potassium in guard cells is also responsible for the induction of
a) Apical dominance
b) Triple response growth
c) Cell division
d) Abscission

323. Choose the correct option in accordance to the statements given above
I. The positive hydrostatic pressure is also called as turgor pressure
II. Wall pressure is exerted to prevent any increase in protoplasm size
III. Osmosis is the movement of substances, which takes place along a diffusion gradient
IV. Plasmolysis is the result of reverse osmosis
a) I, II, III are correct IV is incorrect
b) II, I are correct, while IV and III are incorrect
c) III and IV are correct, while I and II are incorrect
d) Only II is correct

324. Water channels are possessed by a membrane to facilitate the movement of hydrophilic substances. These channels are made up of
a) Eight similar type of aquaporin
b) Eight different type of aquaporin
c) Eight similar and eight different aquaporin
d) Do not possess any water channel

325. Who described mass flow hypothesis?
a) Munch
b) Sir JC Bose
c) Kursanov
d) Buchmann and Priestly

326. Water can be absorbed from a hypertonic external solution by

a) Withdrawing more water from the external solution
b) Auxin treated cells
c) Adding a buffer in the external solution
d) Cytokinin treated cells

327. In a fully turgid cell, ..... is zero.
a) OP
b) TP
c) WP
d) DPD

328. Why the transport of organic food through phloem is bidirectional?
a) Roots serve as source while leaves are the sink region
b) Source and sink region are irreversible
c) The relationship between the two region (source and sink) is variable and is dependent on season and plant needs
d) Translocation of organic solute is regulated by energy

329. Cohesion theory of water movement in plants was put forth by
a) Melvin cycle
b) F F Blackman
c) T W Engelmann
d) Henry Dixon

330. Choose the correct statements regarding the uptake of mineral nutrients and food in plants
a) Even a little amount of exchange of material does takes place between xylem and phloem
b) Most of the minerals enter the root through active absorption
c) Due to variable relationship between source and sink direction of sap flow in phloem is bidirectional
d) All of the above

331. According to the transpiration-cohesion theory, the upward pull of water is transmitted to other water molecules by cohesion, which is caused by
a) Hydrogen bond
b) Hydrophilic cell walls
c) Turgor pressure
d) Osmosis

332. In plants, continuous water supply is due to
a) Osmosis
b) Imbibition
c) Guttation
d) Adhension-cohension forces

# TRANSPORT IN PLANTS

## : ANSWER KEY :

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) | b | 2) | c | 3) | a | 4) | a | 161) | b | 162) | b | 163) | b | 164) | c |
| 5) | c | 6) | a | 7) | c | 8) | d | 165) | b | 166) | c | 167) | a | 168) | c |
| 9) | a | 10) | c | 11) | a | 12) | a | 169) | b | 170) | d | 171) | b | 172) | b |
| 13) | a | 14) | d | 15) | c | 16) | a | 173) | d | 174) | b | 175) | a | 176) | d |
| 17) | a | 18) | d | 19) | d | 20) | c | 177) | c | 178) | d | 179) | a | 180) | b |
| 21) | b | 22) | a | 23) | d | 24) | a | 181) | b | 182) | b | 183) | d | 184) | c |
| 25) | a | 26) | c | 27) | c | 28) | a | 185) | c | 186) | b | 187) | a | 188) | a |
| 29) | a | 30) | b | 31) | c | 32) | a | 189) | c | 190) | a | 191) | a | 192) | b |
| 33) | a | 34) | c | 35) | a | 36) | b | 193) | a | 194) | a | 195) | a | 196) | b |
| 37) | b | 38) | d | 39) | c | 40) | a | 197) | a | 198) | a | 199) | a | 200) | b |
| 41) | a | 42) | b | 43) | b | 44) | d | 201) | b | 202) | a | 203) | b | 204) | c |
| 45) | a | 46) | c | 47) | c | 48) | c | 205) | d | 206) | b | 207) | c | 208) | c |
| 49) | b | 50) | d | 51) | c | 52) | a | 209) | a | 210) | a | 211) | c | 212) | c |
| 53) | b | 54) | c | 55) | c | 56) | d | 213) | b | 214) | c | 215) | a | 216) | a |
| 57) | d | 58) | c | 59) | c | 60) | b | 217) | b | 218) | c | 219) | b | 220) | b |
| 61) | b | 62) | c | 63) | c | 64) | d | 221) | d | 222) | b | 223) | d | 224) | d |
| 65) | c | 66) | c | 67) | a | 68) | c | 225) | d | 226) | b | 227) | c | 228) | b |
| 69) | a | 70) | a | 71) | a | 72) | c | 229) | a | 230) | c | 231) | a | 232) | b |
| 73) | d | 74) | a | 75) | a | 76) | d | 233) | d | 234) | c | 235) | d | 236) | c |
| 77) | b | 78) | c | 79) | d | 80) | a | 237) | d | 238) | b | 239) | a | 240) | d |
| 81) | a | 82) | a | 83) | a | 84) | a | 241) | b | 242) | d | 243) | d | 244) | d |
| 85) | a | 86) | b | 87) | c | 88) | c | 245) | a | 246) | d | 247) | a | 248) | a |
| 89) | b | 90) | b | 91) | a | 92) | d | 249) | b | 250) | c | 251) | b | 252) | a |
| 93) | a | 94) | a | 95) | b | 96) | a | 253) | a | 254) | d | 255) | a | 256) | b |
| 97) | d | 98) | a | 99) | a | 100) | b | 257) | a | 258) | b | 259) | b | 260) | a |
| 101) | b | 102) | b | 103) | a | 104) | b | 261) | d | 262) | a | 263) | d | 264) | c |
| 105) | d | 106) | b | 107) | a | 108) | b | 265) | d | 266) | c | 267) | b | 268) | b |
| 109) | c | 110) | a | 111) | c | 112) | b | 269) | d | 270) | a | 271) | b | 272) | a |
| 113) | a | 114) | c | 115) | c | 116) | a | 273) | b | 274) | a | 275) | c | 276) | a |
| 117) | a | 118) | b | 119) | d | 120) | c | 277) | c | 278) | b | 279) | b | 280) | d |
| 121) | a | 122) | c | 123) | d | 124) | b | 281) | d | 282) | b | 283) | d | 284) | b |
| 125) | d | 126) | c | 127) | c | 128) | c | 285) | c | 286) | b | 287) | d | 288) | b |
| 129) | c | 130) | d | 131) | c | 132) | c | 289) | d | 290) | d | 291) | b | 292) | a |
| 133) | c | 134) | b | 135) | a | 136) | a | 293) | a | 294) | d | 295) | d | 296) | a |
| 137) | c | 138) | a | 139) | c | 140) | b | 297) | c | 298) | d | 299) | b | 300) | d |
| 141) | c | 142) | b | 143) | d | 144) | c | 301) | c | 302) | a | 303) | d | 304) | c |
| 145) | a | 146) | a | 147) | c | 148) | c | 305) | c | 306) | b | 307) | a | 308) | a |
| 149) | b | 150) | b | 151) | c | 152) | c | 309) | b | 310) | c | 311) | a | 312) | a |
| 153) | a | 154) | d | 155) | b | 156) | b | 313) | a | 314) | b | 315) | d | 316) | b |
| 157) | c | 158) | c | 159) | a | 160) | c | 317) | a | 318) | a | 319) | a | 320) | b |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 321) | a | 322) | c | 323) | a | 324) | b |
| 325) | a | 326) | b | 327) | d | 328) | c |
| 329) | d | 330) | d | 331) | a | 332) | d |

# TRANSPORT IN PLANTS

## : HINTS AND SOLUTIONS :

1 **(b)**
The given diagram represents the transport of two type of molecules by carrier proteins, which is achieved with the activity of membrane proton pump to solute exchange. 'A' depicts, uniport method of transport-molecule move across the membrane
'B' shows antiport method and symport method (transport in same direction) is shown by 'C' in the given diagram

2 **(c)**
Aquaporins are present in cell membranes. They facilitate the transport of water soluble substances through it. Aquaporins are also known as channel proteins

3 **(a)**
Plasmolysis

4 **(a)**
Addition of solutes in a system or cell decreases the energy of water. Pure water has the maximum diffusion pressure. Water potential or chemical potential of pure water is the difference in the free energy per unit molal volume of water in a system in reference to pure water at normal temperature and pressure

5 **(c)**
The movement of sugars in the phloem begins at the source, where sugars are loaded (actively transported) into a sieve tube. Loading of the phloem steps up a water potential gradient that facilitates the mass movement in the phloem

6 **(a)**
The evaporative loss of water in the form of vapours form the exposed part of plant is known as transpiration. This evaporative loss of water due to process of transpiration varies from plant, *i.e.,* around 2 L per day in sunflower, while it is one tonne per day in elm tree. Rate of transpiration is affected by relative humidity, temperature, light, wind speed, atmospheric pressure and availability of water

7 **(c)**
In herbaceous plants, when root pressure is high and transpiration is low, plants may lose this extra water in liquid drops from margins of leaves. This process is called **guttation**. It is very common during warm and humid nights. These water drops contain salts, amino acids, etc.

8 **(d)**
Water always moves from area of high water potential to area of low water potential, i.e., from less negative to more negative. During water absorption by root hair, the water movement is possible if water potential of vacuolar sap is lower than root hair.

9 **(a)**
The water remaining in dry soil and held as very thin films around the soil particles is called hygroscopic water.

10 **(c)**
Root pressure, a manifestation of active water absorption is developed in xylem sap of roots of same plants. It maintains optimum metabolic activity and reduce transpiration and provide a light push in overall process of water transport because root pressure cannot transport water upto the whole length of plant. Movement of water is shown through xylem.
In symplastic movements, movement of water occurs from cell to cell through their protoplasm, which are connected by a bridge called plasmodesmata

11 **(a)**
Transport of substances through membrane from region of higher concentration to lower

concentration needs energy and transport is called active transport

12 **(a)**
The value by which the diffusion pressure of a solution is lower than that of pure solvent is known as diffusion pressure deficit.
DPD or SP=OP-TP
At the equilibrium TP=WP
DPD=OP-WP.

13 **(a)**
The stomatal aperture is surrounded by guard cells having chloroplasts

14 **(d)**
Mature stems of woody plants have a peripheral water proof tissue called cork (phellem). A number of scars known as lenticels are found on the surface of cork. Lenticels allow the gaseous exchange between atmosphere and living cells below the cork and also take parts in transpiration (0.1 %).

15 **(c)**
In the light, the pH of guard cells becomes increased due to consumption of $CO_2$ in the process of photosynthesis. Guard cells receive $K^+$ions from subsidiary cells. This decreases the water potential of guard cells and leads to migration of water from subsidiary cells to guard cells.
Uptake of $K^+$ ions is also balanced by $Cl^-$ ions.

16 **(a)**
Sorghum has high shoot root ratio (due to more length) than maize. According to **Parker** (1949), the ratio of transpiration is directly proportional to shoot-root ratio.

17 **(a)**
If a plant cell is placed in a hypotonic solution/pure water, water starts moving in by endosmosis. As the volume of the protoplast increases, it begins to exert pressure against the cell wall (turgor pressure). Normally, wall pressure is equal and opposite to turgor pressure except when cell becomes flaccid, So if cell's turgidity increases, wall pressure also increases.

18 **(d)**
Hormones, amino acids and sugars are transported or translocated through phloem

19 **(d)**
Stocking has defined root pressure as a pressure developed in the treachery elements of xylem as a result of metabolic activities of root. It is said to be a active process and appears due to osmosis.

20 **(c)**
It is demonstration of transpiration by bell jar experiment. It this experiment a potted plant is placed on a slab and a dry bell jar is inverted over it. Having sealed the edge of jar with wax or Vaseline, the whole apparatus is left undisturbed. After sometimes the inner surface of bell jar became misty due to transpiration by plant

21 **(b)**
Xylem sap is composed of minerals and water and is not driven by higher concentration of sugars, while rapid flow of water does not affect the conducting tissue and only the rate of transpiration is increased

22 **(a)**
The most significant physiological feature of stomata is their **response to light**. Generally stomata open in the day time, i.e., light and close at night or in darkness. These are called as **photoactive** stomata. However, in succulent plants like Kalanchoe of family- Crassulaceae, the stomata open at night and close in the day time. Such stomata are called **scotoactive** stomata.

23 **(d)**
The direction of movement in phloem is bidirectional and that of xylem is unidirectional. Since the source-sink relationship is variable, the direction of movement in the phloem can be upwards or downwards, *i.e.,* bidirectional. This contrast with that of the xylem, where the movement is always unidirectional, *i.e.,* upwards

24 **(a)**
**Pulsation theory** for ascent of sap was proposed by an eminent Indian scientist **J C Bose**.

25 **(a)**
The water potential is the chemical potential of water in a system or part of a system expressed in units of pressure and chemical

potential of pure water at same atmospheric pressure and temperature.

26 **(c)**
The solution whose osmotic concentration (solute potential) is equal to that of another solution is called **isotonic solution**.

27 **(c)**
Plants obtain most of their carbon and oxygen from $CO_2$ present in the atmosphere

28 **(a)**
When plant cell is kept in saline water, exosmosis takes place, as a result of which cell **decreases in size**.

29 **(a)**
When carrier proteins allow two type of molecular movements together, it is termed as co-transport. It can be further divided into two types; symport and antiport. In symport process, two types of material are diffused in same direction

30 **(b)**
In 1980, **Julius von Sachs**, a German botanist, demonstrated for the first time that plants could be grown to maturity in a defined nutrient solution in complete absence of soil. This technique of growing plants in a nutrient solution is known as **hydroponics**. These methods require purified water and mineral nutrient salts.

31 **(c)**
It is because of the close packing of water molecules in the inter spaces and over the surface of the imbibant particles

32 **(a)**
In rooted plants, transport of inorganic substances like water and minerals occur by xylem and it is unidirectional in case of water

33 **(a)**
**Guttation** is loss of water in liquid form from uninjured part in plants. This water loss occurs through hydathodes or water stomata. Guttation usually occurs from tips and margins of leaves during early morning when there is high atmospheric humidity as during wet reasons. Water stomata or hydathodes are permanently opened pores.

34 **(c)**
**Imbibition** is a special type of diffusion when water is absorbed by solids colloids causing them to enormously increase in volume. The classical examples of imbibitions are absorption of water by seeds and dry wood.

35 **(a)**
A-Final level B-Dotpin
C-Initial level D-Sugar solution
E-Potato tuber

36 **(b)**
Transport of water and mineral in xylem is unidirectional and sap move upwards due to transpirational pull. While transport in phloem is bidirectional and multidirectional, transport of organic food by phloem takes place from the source to sink

37 **(b)**
The rate of transpiration can be reduced by using anti-transpirants. These can be used in two ways

1. Metabolic inhibitors: PMA, ABA, aspirin
2. Film forming antitranspirant: Silicon, low viscosity, waxes.

BAP (Benzyl amino purine) is a cytokinin.

38 **(d)**
Statoliths are microscopic particles. According to statolith theory given by **Haberlandt** and **Nemec** (1900), the change in position of statoliths under the influence of gravitation causes differential growth.

39 **(c)**
In a plasmolysed cell, the space between nucleus and plasma membrane is occupied by isotonic solution.

40 **(a)**
Sugarcane (*saccharum officinarum*) is a monocot plant of family-Poaceae. In gases (Poaceae), the guard cells are dumb bell-shaped and their cell walls are thickened only in the middle.

41 **(a)**
The water potential and osmotic potential of pure water is zero

42 **(b)**
Proteins have a very high imbibing capacity, starch less and cellulose least. This is why the

proteinaceous seeds, e.g., pea seeds will show more imbibiton than those of wheat seeds.

43 **(b)**
Turgor pressure causes movements

44 **(d)**
Diffusion process takes place between concentration of molecule solution and it is process, where the movement of molecules occur from a higher concentration to lower concentration, either it is internal or external. Higher the concentration gradient, higher will be the rate of diffusion

45 **(a)**
In a ringing or Girding experiment, the ring of bark, along with phloem is cut from the stem to represent the path of organic nutrients by phloem tissue. If phloem is not removed along with bark, supply of organic food will be continue and plant will survive. It xylem is girdled from main stem, supply of minerals and salts is stopped in the leaves and upper part of girdling site.
So, wilting of leaves takes place after sometimes. In girdling experiment, root dies first as supply of food is stopped. In flowering plant, sieve tube transport food in the form of disaccaharides (sucrose)

46 **(c)**
Generally, stomata are provided for water loss but plants, which grow in xeric habitat have sunken type of stomata in their lower epidermis of leaves to minimize the loss of water, *e.g., Nerium.*

47 **(c)**
Cohesion tension theory was proposed by Henry Dixon and Jolly in 1894. It is greatly supported and elaborated by Dixon (1914, 1924). It is also called as transpiration pull theory and is based on the following assumptions
1. Cohesive and adhesive properties of water molecules
2. Continuous water column from root hairs through stem to tip of leaves
3. Strong transpiration pull exerted by all the transpiring leaves on the stem

48 **(c)**
The given diagram represents the process of osmosis. *i.e.,* the movement of water from its higher concentration to lower concentration through a semipermeable membrane

49 **(b)**
An account of 90% total transpiration occurs through leaves, *i.e.*, foliar. Remaining 10% takes place through stem, flower and fruits etc. Cauline transpiration is the loss of water from stem. Ascent of sap in conducting tissues of plant is affected by cohesion, adhesion and properties of water

50 **(d)**
The food material synthesizes in leaves of green plants and from seed during germination is translocated to growing regions and storage organs of plant.

51 **(c)**
Capillary water is the water present in narrow spaces or microspores of the soil. It is held in the soil by capillary force and therefore, does not fall down to water level. Capillary water is absorbed by plant roots.

52 **(a)**
ABA theory to explain the mechanism of stomatal closure was proposed by **Cowan** *et al*, in 1982. According to it formation of abscisic acid (during drought or mid-day) promotes reversal of $H^+ \rightleftharpoons K^+$ pump and increases availability of $H^+$ inside the guard cell cytoplasm and stomata close. Active $K^+$ transport theory for opening and closing of a stomata, was proposed by **Imamura** (1943) and **Fujino** (1967). Proton $(H^+ - K^+)$ transport theory was proposed by **Levitt** (1974).

53 **(b)**
$K^+$ions regulate the opening and closing of stomata. Increased concentration $K^+$ and malate ions in the guard cells increases the OP of guard cells, which results in decrease of water potential. Due to which water enters from adjoining subsidiary cells into guard cells by endosmosis. Turgor pressure of guard cells increases, which results in the opening of stomata.

54 **(c)**
Mineral exists in soil as ions which are generally absorbed from the soil by both active and passive transport. Because sometimes concentration of ions in soil is 100 times more as compared to

concentration in root system in its interior. So, all mineral cannot be absorbed passively

55 **(c)**
Root hair zone (cell differentiation zone) in plants is a specialised structure for water absorption. It is the most efficient water absorption region in roots. Inspite of water absorption, root hair zone or root cells are incapable for photosynthesis because of the absence of chlorophyll but use oxygen for respiration

57 **(d)**
Adhesion is the attraction of unlike molecules to each other, such as that between water and the walls of xylem vessels in plants.

58 **(c)**
A trichome is initiated as a protuberance from an epidermal cell. Generally, a dense covering of woody trichomes controls the rate of transpiration. They also reduce the heating effect of sunlight. They aid in the protection of plant body from outer injurious agencies.

59 **(c)**
The guard cells of stomata in land plants are specialized epidermal cells which contain chloroplasts. In rest of epidermal cells, chloroplasts are absent. But chloroplasts of guard cells are capable of poor photosynthesis as there is absence of NADP reductase enzyme.

60 **(b)**
The movement of water occurs from low DPD cell to high DPD cell. DPD is equal but opposite to water potential (algebraic sum of solute or osmotic potential and pressure potential).

| Cell | Water potential (osmotic potential + pressure potential | DPD |
|---|---|---|
| A | -1+0.5=-0.5 | +0.5 |
| B | -0.6+0.3=-0.3 | +0.3 |
| C | -1.2+0.6=-0.6 | +0.6 |
| D | -0.8+0.4=-0.4 | +0.4 |

So, the correct sequence of the path of movement of water is
B → D → A → C.

61 **(b)**
The experimental set up shown in the diagram is simple potometer used for measuring the rate of transpiration. In simple potometer, when water is lost by the plant, it is taken from the glass tube and as a
result, the mercury column rises

62 **(c)**
According to active $K^+$ theory of Levitt, the stomatal opening and closing is regulated by ATP driven $K^+$ exchange pump. According to this theory, there is a accumulation of $K^+$ in the guard cells during day time 200. When guard cells have more $K^+$, endosmosis takes place, resulting in the lowering of osmotic potential of guard cells. They starts to absorb water from neighbouring cells and becomes turgid to make a pore or opening in the stoma.
Thus, stomatal opening takes place. Due to the loss of $K^+$ the osmotic concentration of guard cells in comparison to adjoining epidermal cells decreases. Therefore, exosmosis takes place and guard cells becomes flaccid due to the loss of turgidity. Thus, stomatal closure takes place

63 **(c)**
During the transport of water from the soil to xylem, water moves through mainly two channels, *i.e.*, symplast and apoplast. Symplast when water moves between adjacent cell through cytoplasmic connection and when water moves through cell wall, it is called apoplatic movement

64 **(d)**
Water potential is the difference in free energy or chemical potential per unit molal volume of water in a system in reference to pure water at normal temperature and pressure and by increasing the pressure its value also increases

65 **(c)**
The imbibants have negative water potential. As a result when they come in contact with water, a steep water potential is established between the imbibant and imbibate

66 **(c)**
Phloem sap is composed of organic substances in soluble forms. Sugar, hormone and water are the constituent of phloem sap. If one analyse the phloem sap chemically, presence of nitrogen and mineral is expected in least amount. While in xylem sap, its presence will be more

67 **(a)**
Mineral ions are frequently remobilised, particularly from older, senescing parts. Older dying leaves export much of their mineral content

to younger leaves. Similarly, before leaf fall in decidous plants, minerals are removed to other parts. Elements most readily mobilised are phosphorus, sulphur, nitrogen and potassium. Some elements that are structural components, like calcium are not remobilised

68 **(c)**
Diffusion is process, which occurs in three forms of matter, *i.e.,* solid, liquid and gas. The process occurs along the concentration gradient, *i.e.,* movement of molecule takes place from higher concentration area to lower concentration area

70 **(a)**
In plants, water and minerals both are absorbed by the root hairs. Root hair zone is also known as zone of maturation or differentiation as the cells of this zone undergo maturation and differentiation into different types of primary tissues of the root.

71 **(a)**
DPD or Diffusion Pressure Deficit is an older term, which was used for water potential. Due to the pressure of DPD in a solution, it tends to make up the reducion in diffusion pressure by absorbing water. Therefore, DPD is also called as suction pressure

72 **(c)**
Transport of water soluble substances (glucose, sodium ions and chloride ions) is facilitated by transport proteins. The transport proteins are embedded in the lipid bilayer of cellular membranes and provide sites at which such molecules cross the membrane
The transport proteins themselves do not create a concentration gradient. A concentration gradient must already be present in order to facilitate diffusion. A transport protein simply provides a binding site that binds the specific molecule (*e. g.*, glucose) or ion to be transported
After binding the specific molecule, the transport protein changes its shape and carries the molecule across the membrane where it releases the molecule. The transport protein returns to its original shape and waits to catch another molecule to be transported

73 **(d)**
Process of diffusion is actively involved in various processes of life like transpiration by plants, respiration in livings and photosynthesis. It is a part of all the three processes

74 **(a)**
Munch (1930) proposed the pressure flow hypothesis which best explain the transport of organic nutrients from the source (supply) to sink (utilisation site). According to this theory, source shows a high osmotic concentration than the sink. When the organic substances from mesophyll cells are (act as source) passed to the sieve tube of phloem through their companion cell by active transport, a high osmotic concentration is developed in sieve tube and acts as a source. Water is absorbed by sieve tubes from the adjacent xylem and develop a high turgor pressure. Thus, the transpiration of organic nutrient takes place from a region of higher turgor region to the area of lower turgor pressure

75 **(a)**
Each stoma (pl. stomata) remains surrounded by two small, specialized, green, kidney-shaped epidermal cells called guard cells, which are rapidly influenced by turgor changes. Adjacent to each of the guard cells are usually one to several other modified epidermal cells called **accessory** or **subsidiary cells**.
**Sclerenchymatous cells** are thick-walled lignified, dead cells supportive in function. These are not related with the structure of stomata.

76 **(d)**
A-Stomal aperture, B-Guard cell, C-Cellulosic microfibrils

77 **(b)**
**Guttation** is the loss or exertion of water in the form of liquid droplets from the leaves and other parts of an uninjured or intact plant. Guttation takes place through special structures called **hydathodes**. Water lost during guttation contains inorganic and organic components so, it is not pure.

78 **(c)**
Zone of cell differentiation or root hair zone is the most efficient region of water absorption in plants, which is made up of thousands of root hairs. This zone is 1-6 cm in length. Root hairs are

specialised to absorb water and are 0.05-1.5 mm in length and 10 um in breadth

79 **(d)**
The upper epidermises of monocots have large, thin walled and empty bulliform cells or motor cells containing water. These cells are mainly concerned with rolling and unrolling of leaf. The epidermis is cuticularized.

80 **(a)**
The movement of $H_2O$ occurs from high value of $\Psi_w$ to low value of $\Psi_w$, *i.e.,* from less negative value to more negative value of $\Psi_w$

81 **(a)**
The rate of transpiration can be measured by Farmer's protometer or Ganong's photometer. These are based on the assumption that the rate of transpiration is nearly equal to the rate of absorption of water. The opening and closing of stomata are measured by porometer.

82 **(a)**
A cell swells up when kept in **hypotonic** solution due to process of endosmosis.

83 **(a)**
Diffusion is rapid in gases then in liquid diffusion of water through semipermeable membrane is called osmosis.

84 **(a)**
When a plasmolysed cell is placed in hypotonic solution, i.e., of lower osmotic pressure, it regains its normal shape and size due to DPD (Diffusion Pressure Deficit).

DPD=OP-TP

85 **(a)**
Due to wilting, the water potential becomes equal to osmotic potential.

86 **(b)**
Sugar stored in roots may be mobilised to become a source of food in the early spring as the source and sink may be reversed depending on the season

87 **(c)**
*Pinus* and orchid seeds cannot germinate and develop into plants in the absence of mycorrhizal association. In mycorrihzal association, the fungal hyphae are specialised for absorption of water and minerals by extending sufficient distance into soil. The mycorrhizal association between fungus and roots of plant are obligate. Absorption of water along with mineral is an active absorption and followed by osmosis. Fungus are heterotrophic

88 **(c)**
**Water potential** is the difference in the free energy or chemical potential per unit molal volume of water in a system and that of water at the same temperature and pressure. It is represented by greek letter
$\Psi$ (psi) or $\Psi_w$. The value of $\Psi_w$ is measured in bars, pascals or atmospheres, i.e., units of pressure.

90 **(b)**
Due to continuous transpiration from the leaves surface, mesophyll cells of leaves withdraw water from deeper cells as its molecules are binded by hydrogen bond. Deeper cells obtain water from tracheary elements, which in turn cause a tension in water column of tracheary elements.
As this tension is created by transpiration, it is referred to as transpirational pull. On account of this tension, the water column of plant is pulled up passively below the top most part of plant. A transpiration pull of 10-20 atm is sufficient to left the water up to the height of tallest plant over 130 metre

91 **(a)**
Generally, stomata are associated with the water loss from aerial parts of plants. But plants which grow in xeric habitat have sunken stomata in their lower epidermis of leaves to minimise the loss, *e.g., Nerium*

92 **(d)**
When a leaf peeling of *Tradescantia* is kept in a medium having 10% NaCl solution, the cells shrink in size, this is followed by separation of protoplast from cell wall due to exosmosis. This phenomenon is called **plasmolysis**.

93 **(a)**
Osmosis

94 **(a)**
The stomata presents in xerophytes, open at night.

95 **(b)**
ABA (abscisic acid) causes stomata to close by inhibibition of an ATP dependent pump in the plasma membrane of guard cells. The

application of exogenous ABA on leaves of normal plants causes closing of stomata within a few minutes. ABA acts in the presence of $CO_2$, which decreases the pH of guard cells. ABA includes the loss of $K^+$ions, which decreases the osmotic concentration of guard cells as compared to adjacent epidermal cells. This causes exosmosis and turgidity of guard cell decreases.

96 **(a)**
The direction of translocation, *i.e.*, transport of organic substances and mineral nutrients is multidirectional. However, it is unidirectional in case of water and minerals

97 **(d)**
A mechanism involving electro-osmosis was proposed independently by **Fensom** (1957) and **Jones** (1958). According to this hypothesis, the solute moves in positive direction of electrical gradient along with $K^+$ ions.

98 **(a)**
In both, facilitated diffusion and active transport, there is an involvement of carrier transporter or transporter proteins. These are highly specific enzymes and shows sensitivity to inhibitors

99 **(a)**
Water potential is the difference in free energy or chemical potential per unit molal volume of water in a system and that of pure water at the same temperature and pressure. The water potential of pure water is zero and it decreases on addition of solutes.

100 **(b)**
Long distance transport of organic and inorganic substances in plants occur through complex permanent tissues. Vascular tissues are also permanent tissues, *i.e.,* xylem and phloem

101 **(b)**
Xylem sap is water with dissolved ions. Unidirectional upward movement of water and mineral from the soil to the tip of leaves through stem and branches of plants is called as ascent of sap, which is carried out by tracheary elemental, xylem

102 **(b)**
Passive absorption of minerals takes place as mass flow, simple diffusion, facilitated diffusion, ion exchange, Donnan equilibrium.

103 **(a)**
Pressure potential or positive hydrostatic pressure or turgor pressure is the pressure, which develops in the confined part of an osmotic system due to the osmotic entry of water in it

105 **(d)**
Transport of minerals through xylem from the soil to plant takes place by active transport. This active transport need energy to move molecules against the concentration gradient. This is facilitated with membrane proteins due to less concentration of minerals ions in the soil. minerals are transported into root cells by active transport

106 **(b)**
A-unidirectionally, B-casparian strips

107 **(a)**
In the majority of the plants, the shape of guard cells in stomatal apparatus are kidney-shaped in outline, which are joined at their ends. In the members of Cyperaceae and Poacease, the shape of guard cells is dump-bell shaped in outline. Their middle portion are thick walled, while expanded ends are thin walled

108 **(b)**
Transpiration pull.
If the stem of plant is cut under a state of tension in xylem sap, the air will be pulled into the xylem and the transport of water (xylem sap) remains in continuity. However, it can be discontinued with the introduction of air bubble in the xylem. Copeland (1902) believed that air bubbles enter into the xylem and break the tensile strength or cohesion force between the water molecule

109 **(c)**
Munch proposed mass flow hypothesis. This is also known as Munch hypothesis. According to this, food material are translocated through phloem along the concentration gradient from the source to sink

110 **(a)**
The water potential ($\Psi_\omega$) is equal to osmotic potential ($\Psi_S$) + pressure potential ($\Psi_P$). Osmotic potential is always in negative value. The water potential is the chemical potential of water, which is equivalant to DPD with negative sign. Therefore, water potential ($\Psi$) of cell A is

$\Psi_A = \Psi_S + \Psi_P = -18 + 8 = -10$

Water potential of cell B ($\Psi_B$) is

$\Psi_B = \Psi_S + \Psi_P = -14 + 2 = -12$

Since, water moves from higher water potential to lower potential, *i.e.,* the flow of water will be from cell A(−10 bars) to cell B (−12 bars)

111 **(c)**

Water molecules in apoplast pathway are unable to penetrate the layer/bond of suberised matrix called the casparian strip

112 **(b)**

Plant, which grows in xeric habitat have sunken stomata in their lower epidermis of leaves to minimise the loss of water like *Nerium* succulent or drought avoiding plant store water (when available in excess) in the form of mucilage, *i.e.,* leaf succulent, while true xerophytes are not succulent, like *Calotropis*

113 **(a)**

Apoplast pathway of water movement inside the root provide the least resistance to movement of water. However, the presence of lignin suberin layer interrupts the water movement. This layer is known as casparian strips

114 **(c)**

A characteristic of mass flow is that the substances, whether in a solution or in a suspension, are swept along at the same pair, as in flowing river. Bulk flow can be achieved either through a positive hydrostative pressure gradient (*e. g.*, a garden hose) or a negative hydrostatic pressure gradient (*e. g.*, suction through a straw)

115 **(c)**

The relationship between the source and sink is variable and depends upon season or need of plant. In early spring season, roots act as source, while the buds of plant begin to behave like utilisation site.

Similarly, during flowering and fruit ripening, the flowers and fruits acts like sink region and their source or supply of organic nutrient is completed from the site or photosynthesis, which are green young and older leaves of plants

116 **(a)**

Because of low atmospheric pressure which permits more rapid diffusion of water. Such plants develop xerophytic characters to avoid this situation

117 **(a)**

After the ions have reached xylem through active or passive uptake, or a combination of the two, their further transport up to the stem to all parts of the plant is through the transpiration stream

118 **(b)**

Process of water absorption and transpiration are carried out continuously in plants. However, around 98-99% of absorbed water by plant is transpired through transpiration

119 **(d)**

Apoplast pathway of water movement inside the root provide the least resistance to movement of water. However, the presence of lignin suberin layer interrupts the water movement. This layer is known as casparian strips

120 **(c)**

The net force with which water is drawn into a cell or root hair is equal to difference of OP and TP and is known as diffusion pressure deficit or suction pressure. DPD of pure water is maximum (=1236 atm) and solvent moves from cell of low DPD to high DPD.

DPD or SP=OP-TP

121 **(a)**

The water which is found freely in the pervious rocks and deep in the soil is called groundwater. It occurs above the impermeable stratum. Its upper layer is known as water table

123 **(d)**

If the stem of plant is cut under a state of tension in xylem sap, the air will be pulled into the xylem and the transport of water (xylem sap) remains in continuity. However, it can be discontinued with the introduction of air bubble in the xylem. Copeland (1902) believed that air bubbles enter into the xylem and break the tensile strength or cohesion force between the water molecule

124 **(b)**

The most accepted theory of ascent of sap is transpiration pull theory or cohesion-tension theory proposed by Dixon and Jolly. Loss of water from mesophyll cells of leaf through transpiration creates transpiration pull or tension, which is transmitted downward and is relieved when water is absorbed through roots.

125 **(d)**

Diffusion is a slow process. It does not depend on the living system and there is no need of energy. It

can take place in adjacent cells, adjacent tissues and from one type of tissues to another. It is rapid over short distances. However, it is extremely slow over long distance transport

126 **(c)**
Loss of water from the aerial parts of plant through continuous transpiration causes a suction pressure or tension in the water column of plant. This tension develops due to transpiration and is also called as transpirational pull

127 **(c)**
Dry weight of plants can be calculated roughly by reducing its water contents. The average dry weight of herbaceous plants is 10-15% of its fresh weight

128 **(c)**
The net force with which water is drawn into cell or root hair is equal to difference of OP and TP and known as **diffusion pressure deficit** or **suction pressure**, i.e.,

SP or DPD=OP-TP.

129 **(c)**
When a cell is placed in hypertonic solution, the protoplasm shrinks and leaves the cell wall due to exosmosis and cell becomes failed. The space between plasma membrane and cell wall of plasmolyzed cell is occupied by hypertonic solution.

130 **(d)**
Water is absorbed by germinating seeds through the process of imbibitions and helps in rupturing of seed coat. Imbibition is the process of absorption of water by hydrophilic surface of a substance without forming a solution. It is a type of diffusion by which movement of water takes place along a diffusion gradient. During the process of imbibitions, volume of imbibant is changed, heat is produced and imbibitional pressure is developed.

131 **(c)**
Water potentials of the given cells are

$$\Psi = \Psi_s + \Psi_p$$

A=-0.87+0.44=-0.43
B=-0.92+0.34=-0.58
C=-0.68+0.27=-0.41

As water moves from greater water potential to less, root hair, root cortical and leaf mesophyll cells are C, A, B respectively.

132 **(c)**
**Transpiration pull** and **cohesion-tension theory** was proposed by **Dixon** and **Jolly** (1894). The molecules form a continuous column by cohesion. The cell walls of xylem vessels have a strong affinity for water molecules, i.e., adhesion. Loss of water from aerial parts through transpiration causes a suction pressure in the water column of plant, which is called transpiration pull.

133 **(c)**
A-Phloem, B-Sugars enters the sieve tube, C-Sugars leaves the sieve tube

134 **(b)**
Being a positive force, turgor, pressure opposes the entry of water if large amount of water enters in a plant cell

135 **(a)**
Suction pressure or transpiration pull is a tension caused by transpiration from the surface of leaves in a plant. This tension or pull creates a tension in the water column of xylem, which in turn absorbs water from the soil along with minerals. Absorption of ions or minerals is affected by transpirational pull. Pressure flow hypothesis or Munch flow hypothesis depends completely on the existence of mechanism for loading organic nutrients (sugars) into sieve tube phloem and deliver the same to the site of utilisation. Source sink relationship is variable

136 **(a)**
Opening of stomata does not affected by **$N_2$**(nitrogen). $N_2$ is present in free state in atmosphere/air, which is used in nitrogen fixation by some important bacteria but does not affect the opening and closing of stomata.

137 **(c)**
Osmosis is flow of solvent from lower concentration to higher concentration of solution through a semi-permeable membrane.

138 **(a)**
Cohesion force is one of the force responsible for water transport in xylem tissue. It is the force between water molecule. Water molecules remain

joined to each other due to cohesion force. Water column present in the tracheary element of xylem can bear a tension or pull of up to 100 atm only due to cohesion force. So, this is also known as tensile strength

139 **(c)**

Osmosis is the diffusion of water molecules through a differentially permeable membrane. Endosmosis leads to diffusion of water into the cell and thus, cell becomes turgid.

141 **(c)**

In **apoplast pathway**, water passes from root hair to xylem through the walls of intervening cells without crossing any membrane or cytoplasm.

Water potential of pure water at atmospheric pressure is 0 Mpa, addition of solutes reduce water potential (to a negative value).

In **symplast pathway**, water passes from cell to cell through their protoplasm. It does not enter cell vacuoles. The cytoplasms of the adjacent cells are connected through bridges called **plasmodesmata**.

**Membrane permeability** is the ability of a membrane to allow passage of gases, liquids, solutes (dissolved substance) through it. It is depend upon two factors- nature of membrane (membrane composition) and nature of passing substance.

142 **(b)**

The pressure exerted by the protoplasm against the cell wall is called **turgor pressure**. Turgor pressure maintains the shape of a cell.

143 **(d)**

Transporter proteins are integral part of both facilitated and active type of transport method. Carrier proteins found in facilitated diffusion and active transport are different and specific. Generally, facilitated diffusion is not an energy involvement process.

While active transport needs energy. Transporate of substances in active process reaches to maximum level (saturation point) when all the proteins are being used completely

144 **(c)**

Root hair absorbs water from soil through osmosis.

145 **(a)**

Mineral matter in the soil are responsible for holding the water present in the soil. They are of following 5 types according to their size in ascending order clay, slit, fine sand, coarse sand and gravel. Clay having mineral salt, is more active chemically and shows higher capacity to retain water and ions. A loam soil is made up of ratio 1:2:2 of clay, slit and sand respectively. While sandy soil has little clay matter and shows least retaining capacity and is not fit for plant growth

146 **(a)**

Phloem sap is mainly water and sucrose

147 **(c)**

Passive absorption of water by the root system is the result of tension on the cell sap due to transpiration.

148 **(c)**

If the medium is more dense, the molecules, atoms, icons of solids, liquid or gases will take more time to get evenly distributed but equilibrium will positively be reached due to kinetic energy of diffusing particles.

149 **(b)**

Dilute NaCl solution acts as hypotonic solution. So, when flowers are cut dipped in dilute NaCl solution, endosmosis occurs and the cells of flowers swell.

150 **(b)**

**Munch hypothesis** is based on translocation of food due to turgor pressure (TP) gradient.

151 **(c)**

Water potential in a cell is equal to algebraic sum of solute potential and pressure potential.

| Cell | Water Potential | DPD |
|---|---|---|
| A | -0.21+0.05=-0.16 | +0.16 |
| B | -0.22+0.02=-0.20 | +0.20 |
| C | -0.23+0.05=-0.18 | +0.18 |

Water potential is equal but opposite to DPD. Water move from low DPD cell to high DPD cell.

152 **(c)**

Water rises beyond the point at which it would be supported by air pressure because evaporation from the plant leaves (transpiration) produces a force that pulls upward on the entire column of water. The forces of adhesion and cohesion maintain an unbroken column of water. Thus, transpiration facilitates absorption of water by roots.

153 **(a)**
Carrier molecules or carrier proteins involved in facilitated diffusion, facilitate the diffusion of hydrophilic substances through biological membrane. They are specific and allow the cells to select solute of an appropriate size to be transported. Carrier proteins can increase the rate of diffusion and may undergo change upon binding to solutes

154 **(d)**
Phenyl mercuric acetate is used as an antitranspirant.

155 **(b)**
Statement I, II and IV are correct III is incorrect

156 **(b)**
According to Munch flow model or pressure flow hypothesis, the correct sequence of transport of organic nutrients from source to sink is that first of all food material synthesis takes place then it is transported from cell to cell in the leaves from leaves cell (mesophyll cell). It is passed into the sieve tube through their companion cells by an active transport
Now sieve tube shows high osmotic concentration and absorb water from the adjacent xylem.
Having absorbed water, they became turgid and organic nutrients are transported from a region of higher turgor pressure to a region of lower turgor pressure

157 **(c)**
Transpiration is the loss of water from the aerial part of a living plant. Transpiration may be stomatal (90%), cuticular (3-9%) and lenticular (0.1%). Transpiration is absent in submerged, hydrophytes due to the absence of stomata in the leaves of submerged plant, *i.e.*, potamogeton

158 **(c)**
Stomata are minute pore complexes found mainly in the epidermis of leaves. Each stoma is surrounded by two small but specialized green epidermal cells called guard cells. Their walls are differentially thickend and elastic. They control opening and closing of stomata.

159 **(a)**
Wilting occurs, when rate of transpiration is higher than absorption, which leads to excess loss of water than absorption. Transpiration is a physical process, in which the water evaporates in the form of vapours from aerial parts of plants. It may be stomatal, cuticular or lenticular.

160 **(c)**
Positive force-turgor pressure (hydrostatic pressure) or pressure potential ($\Psi_p$) is kept under check by wall pressure. In a plasmolysed cell, turgor pressure is nill therefore, osmotic pressure ($\Psi_s$) becomes equal to DPD ($\Psi_w$)

161 **(b)**
Water present due to surface tension in minute capillaries or pore formed by soil particles is called **capillary water**. It is the only form of soil water which is absorbed by the roots of plants, i.e., available water.

162 **(b)**
Proteins have a very high imbibing capacity, starch less and cellulose least. This is why, the proteinaceous seeds, *e. g.*, pea seeds will show more imbibition than those of wheat seeds

163 **(b)**
The magnitude of root pressure ranges between 1-5 atm.

164 **(c)**
Cell membranes possess certain pores, which are called porin. These are present in the outer membrane of mitochondria, plastids and in some bacteria. These large proteins pores provide passage for small sized proteins. They are also called transport proteins, which can be divided into two types; carrier proteins and channel proteins. Carrier proteins bind to the particular substances, while channel proteins allow movement of an appropriate sized solute to be transported and this in turn is delivered to the outer side of the membrane by carrier proteins

165 **(b)**
When RBC and a plant cell are placed in distilled water, endosmosis takes place as a result of which RBC would increase in size

and burst, while the plant cell would remain about the same size because of the presence of rigid cell wall.

166 **(c)**
Halophytes or plants in saline soil shows maximum osmotic pressure, *e. g.*, *Atriplex confertifolia* has an OP of 202.42 atm. Mesophytes have an osmotic pressure of 5-15 atm, whereas 10-30 atm is exhibited by xerophytes

167 **(a)**
The strinkage of the protoplast of a living cell from its cell wall due to exosmosis under the influence of a hypertonic solution is called **Plasmolysis**. When a cell is plasmolysed, it becomes flaccid. In a flaccid cell, turgor pressure (TP) becomes zero and DPO become equal to OP as DPO= OP- TP.

168 **(c)**
Hydathodes or water pores, unlike stomata, are **always open** as their guard cells are immobile.

169 **(b)**
The water potential ($\Psi$) is equal to osmotic potential ($\Psi_s$) + pressure potential ($\Psi_p$).
Osmotic potential is always in negative value.
The water potential is the chemical potential of water, which is equivalent to DPD with negative sign.
Therefore, water potential ($\Psi_A$) of cell-A is
$\Psi_A = \Psi_s + \Psi_p$=-18+8=-10
Water potential of cell-B($\psi_B$) is
$\Psi_B = \Psi_s + \Psi_p$=-14+2=-12
Since, water moves from higher water potential, the flow of water will be from cell-A (-10 bars) to cell-B (-12 bars).

170 **(d)**
Transpiration can be categorised on the basis of plant surface and are of following types, stomatal transpiration, cuticular transpiration, lenticular transpiration and bark transpiration.
Out of them, stomatal transpiration depend upon the stomata of leaves and continue till the stomata remains open. While transpiration from cuticle, lenticels and bark continues throughout day and night

171 **(b)**
Imbibition is a special type of diffusion when water is absorbed by solids-colloids causing them to enormously increase in volume. The classical example of imbibition are absorption of water by seeds and dry wood

172 **(b)**
Limiting plasmolysis is the first stage of plasmolysis, during which the pressure on the wall is reduced and the wall contracts causing the reduction in cell wall simultaneously. During the second stage, the protoplast withdraws itself from the corners. This stage is known as incipient plasmolysis. Due to continued exosmosis, protoplasts shrink further and withdraws from the cell wall except on or few points. This is the last stage and is called evident plasmolysis

173 **(d)**
Water-a vital component of life that occupy about 72% of the earth surface. There are about 85-90% of fresh weight of the plant tissue comprised of water. Water melon contains around 92% of water of its fresh weight

174 **(b)**
Selectively permeable membrane, viz, membrane of root hair and tonoplast (membrane of vacuole) allows passage of certain substance more readily than others.

175 **(a)**
Symplast is a connection between two cells, which involves, cytoplasm cell membrane and plasmodesmate and not have cell wall in direct contact

176 **(d)**
Movement of hydrophilic moiety substance is facilitated by aquaporin and ion channels, which is the constituent of cell membranes. They plays a role in passive transport of water soluble substances and do not set up a concentration gradient. Hence, diffusion of hydrolphilic substances along the concentration gradient through transporter carrier protein, with no energy involvement is termed as facilitated diffusion

177 **(c)**
Imbibition.
Imbibition is a special type of diffusion when water is absorbed by solids-colloids causing them to enormously increase in volume. The classical example of imbibition are absorption of water by seeds and dry wood

178 **(d)**
**Water potential** is the difference between free energy of water molecules in pure form and energy of water in the solution. Water potential depends on solute concentration, atmospheric pressure.

179 **(a)**
**Succulents** or **drought avoiding plants** sore water (when available in excess) in the form of mucilage, leaf succulent. True xerophytes are non-succulent like *Calotropis*.

180 **(b)**
Transport of organic nutrients from source to sink can be summarised as the osmotic movement of water into sugar loaded sieve tube from adjacent xylem. This creates a higher hydrostatic pressure or turgor pressure in the sieve tube (source) than the sink. Organic nutrients are transported from the region of higher turgor pressure to the region of lower turgor pressure.
Organic nutrient are transported along the concentration gradient and pressure gradient. Sieve tubes and sieve cells of phloem are the channels of transport in flowering plant and non-flowering plant, respectively

181 **(b)**
The path of water movement from soil to xylem is
soil→root hair→cortex→endodrmis→pericycle→protoxylem→metaxylem

182 **(b)**
Stomata of CAM plants are closed during most of the day time and open during night (i.e., scotoactive) because these plants survive in dry and hot environmental conditions. These plants have the capacity to store $CO_2$ during night and this $CO_2$ is used in photosynthesis during day time when stomata are closed.

183 **(d)**
Proton ($H^+ - K^+$) transport theory was proposed by Levitt (1974). According to this theory, there is a accumulation of $K^+$ ions in the guard cells during day time which in turn causes endosmosis, due to a decrease in water potential of guard cell. Guard cells thus, become turgid and stomatal opening takes place

184 **(c)**
$H^+ - K^+$ exchange pump for stomatal movement was given by **Levitt** (1974). According to this, there is accumulation of $K^+$ ions in the guard cells during day time. A rise in pH during day time causes hydrolysis of starch to form organic acid, i.e., phosphoenol pyruvate (PEP).

185 **(c)**
Surface tension does not help in molecular transport. The process of diffusion and osmosis, transport molecules without using energy but in case of active transport, energy (ATP) in utilized.

186 **(b)**
Ascent of sap is passive and occurs along the concentration gradient. Hence, there is no need of energy in the process

187 **(a)**
In roots, endodermis is the innermost layer of cortex. Some of the enddermal cells present opposite to the xylem patches are thin-walled and are called **passage cells** or **transfusion cells.** Passage cells help in transfer of water and dissolved salts from cortex directly into the xylem and ultimately to the pericycle.

188 **(a)**
Active water absorption involves symplast movement of water through living protoplasm, vacuole and plasmodesmata of cells. Passive water absorption involves apoplast (movement of water through inter cellular spaces and cell wall of cells)

189 **(c)**
Concentration gradient must already be present for molecules to diffuse even if facilitated by proteins. Transport rate in facilities diffusion reaches a maximum when all of the protein transporters are being used (saturation)

190 **(a)**
Osmotic pressure of a solution is greater than pure solvent.

191 **(a)**
Measurement of transpiration can be done with the help of potometer. It works on the principle that amount of water absorbed equals the amount of water transpired.

192 **(b)**

The pathway of water movement inside a root is of two types; apoplast pathway and symplast pathway. In symplastic movement, the flow of water occurs from cell to cell through their protoplasm. In this pathway, the adjacent cells are connected through plasmodesmata.
In this system, water has to pass through plasmalemma least at one place. Symplastic moment may be aided by cytoplasmic streaming

193 **(a)**
Transport of minerals through xylem from soil takes place by active transport because the ions are transported against concentration gradient. So, there is a requirement of energy which is provided by ATP

194 **(a)**
Opening and closing of stomata is controlled and regulated by guard cells of stomata. Each stoma is surrounded by two small specialised green epidermal cells. These two cells are called as guard cells. Their walls are differentially thickened and elastic. The shape of guard cells are kidney shaped and dump-bell shaped in dicot and monocot, respectively

195 **(a)**
Stomata are also called **stomates**.

196 **(b)**
The diffusion of hydrophilic substances along the concentration gradient through fixed membrane transport protein without involving energy expenditure, is called facilitated diffusion

197 **(a)**
In Girdling or ringing experiment, the path of organic nutrients in the stem of plant is represented, which is carried out by phloem. In the experiment, a ring of bark along with phloem is cut from the stem. Due to the absence of phloem in the ringing part, translocation of food does not takes place and the same is accumulated above the ring. Bark also swells up and may give rise to adventitious roots

198 **(a)**
Guttation takes place through special structures called hydathodes. There are also called water stomata.

199 **(a)**
A decrease in solute concentration in guard cells will cause decrease in solute potential and thus, an increase in the water potential.

200 **(b)**
Water movement between the two system takes place from the system having higher water potential or more energy to the system containing lower water potential or low energy. So, during water absorption from the soil, the water potential of the root cells is lower than that of the soil

201 **(b)**
Water potential is a concept fundamental to understanding water movement. Solute potential and pressure potential are two main components that determine water potential

202 **(a)**
The rate of transpiration is inversely proportional to the relative humidity, i.e., the rate of transpiration is lower when relative humidity is higher.

203 **(b)**
Guard cells help in transpiration. Each stomatal opening is surrounded by two specialized epidermal cells, called guard cells. Because of their small size guard cells are rapidly influenced by turgor change and thus, regulate the opening and closing of stomata.

204 **(c)**
In plants, water and minerals both are absorbed by root hairs of root hair zone. The root hair zone is also known as zone of differentiation or maturation. The cells of this zone undergo maturation and differentiation into different types of primary tissue of the roots

205 **(d)**
A mechanism involving electro-osmosis was proposed independently by **Fensom** (1957) and **Jones** (1958).

206 **(b)**
Mycorrhiza is a mutual association between fungus and roots of gymnosperms, like *Pinus*. In this relationship the fungal hyphae extends into the soil and absorb water and minerals from the soil. This absorbed minerals and water is handed over to the roots of the plants, which in turn provides sugar and N-compound to the fungal hyphae

207 **(c)**
Facilitated diffusion and active transport are two important processes of movement of substances, into and out of the cells. These two processes are

selective and specific *i.e.,* cells are allowed to select the uptake substances (facilitated diffusion) while active transport is highly specific due to the expenditure of energy

208 **(c)**
A dry alive seed contains around 10-15% water of its weight. Water is a major component of life which is generally absorbed by plants in variable quantity according to their metabolic requirement. A mature maize plant absorb about 3 L water/day, while a mustard plant can absorb the water equal to its weight in only 5 hrs. Hence, water is considered the limiting factor for plant life, growth and development

209 **(a)**
Guttation refers to the exudation of water droplet (in the form of salt solution) from the margins and tips of leaves. Guttation water is exuded from the group of leaf cells through specialized openings or pores called hydathodes. It occurs in some angiosperms like garden nasturtium (Tropaeolum) Colocasia, tomato, etc, and is most noticeable where transpiration is suppressed and relative humidity is high such as during the night. It also takes place early in the morning when soil moisture, root pressure and rate of water absorption are higher.

210 **(a)**
Endodermis

211 **(c)**
The net direction and rate of osmosis depends on both the pressure gradient and concentration gradient

212 **(c)**
Surface tension does not help in the molecule transport.

213 **(b)**
Water is a major component of all living cells. Movement of molecule takes place through cell membranes. Lipid soluble molecules can easily pass through the cell membranes, while hydrophilic substance face difficulty to pass through these membranes

214 **(c)**
Absorption of water is increased when concentration of soil solutes is low, when the soil has low concentration of solutes the water concentration must be more so absorption of water by the cell will b more at relatively high content of water. Because water, moves from higher concentration to lower concentration, i.e., diffusion takes place.

215 **(a)**
When a cell is placed in hypertonic solution, the protoplasm shrinks and leaves the cell wall due to exosmosis and cell becomes flaccid. The space between the plasma membrane and cell wall of plasmolysed cell is occupied by hypertonic water

216 **(a)**
According to the active $K^+$ theory of Levitt, there is influx of $K^+$ in the guard cell from epidermal cells, which are balanced by $Cl^-$. At present, the role of $K^+$ in stomatal opening in universally accepted. In CAM plants, stomata remains closed during day time *e. g.*, *Opuntia*, pineapple etc. Casparian strips present in the walls of endodermal cells control the amount of water and solute, which is absorbed, by the plants, CAM plants have capacity to store $CO_2$ during night and the same is used in photosynthesis during day time when stomata are closed

217 **(b)**
**Active transport** uses specific transporter proteins called pumps, which use metabolic energy (ATP) to move ions or molecules against the concentration gradient.

218 **(c)**
A-control points, B-quantity, C-type, D-xylem

219 **(b)**
Levitt (1974) proposed ATP-driven $H^+ - K^+$ exchange pump mechanism in guard cells for the stomatal opening and closing. According to it, there is accumulation of $K^+$ ions in the guard cells during day time. When guard cells possess more $K^+$, endosmosis takes place lowering the osmotic potential of guard cells, they become turgid and stomatal opening takes place.

220 **(b)**
Diffusion is an important process of transport. It is also related to gaseous exchange in plants. Facilitated diffusion is comparatively a slow process than active transport and transport of molecule occurs along the concentration gradient in diffusion

221 **(d)**
Cohesion adhesion theory for water movement (ascent of sap) in plants water proposed by Dixon and Jolly in 1894 and again elaborated by Dixon (1914, 1924). Now-a-days, this theory for ascent of sap is regarded as most applicable and acceptable in plants transport

222 **(b)**
Seed coats are made up of cellulose. And the cellulose has comparatively little imbibitional capacity, so little water is absorbed and seed coats break. The most important of the plant imbibants are protein, pectic compounds, starch and cellulose, which can imbibe large amount of water. Some of the proteins can imbibe up to 15 times their own volume

223 **(d)**
The chief sinks for the mineral elements are the growing regions of the plant, such as the apical and lateral meristems, young leaves, developing flowers, fruits and seeds, and the storage organs. Unloading of mineral ions occur at the fine vein endings through diffusion and active uptake by these cells

224 **(d)**
To prevent loss of water, tropical deciduous forest trees shed their leaves.

225 **(d)**
In diffusion process, the rate of diffusion of substances depend upon the concentration gradient, permeability of the membrane, temperature and pressure

226 **(b)**
A newly detached twig from a plant exudate a fluid of organic food of plant like sugar from the detached part/cut part. The fluid is known as phloem sap. Vascular tissue phloem transports organic food in plant parts from the origin site or source

228 **(b)**
**Active transport** is the movement of a substance from a region of lower concentration to region of higher concentration i.e., against the concentration gradient. This process involves the movement of free-energy gradient, they require the expenditure of energy from the breakdown of ATP and are, therefore, sensitive to factors affecting metabolism.

229 **(a)**
Diffusion is process in which uncharged molecules pass easily through a biological membrane. However, water soluble substance face difficulty to cross the membrane and the transport of these hydrophilic molecules are facilitated by carrier proteins, which are possessed by cell membrane. The overall process do not require energy and is referred to as facilitated diffusion

230 **(c)**
Very few plants are able to send their roots upto the fringe of water table because of the absence of air. However, phreatophytes are those plant, which can send and absorb the water from water table, *e. g.*, populus deltoides, tamarik, etc.

231 **(a)**
Transport of substances over longer distances through vascular tissue is termed as translocation and this translocation of different substances either inorganic minerals or organic substances (like sugar) occurs through a mass or bulk flow system.
This mass flow of substance is unidirectional in case of water, while it is multidirectional in case of organic solute and minerals

232 **(b)**
The products of photosynthesis are generally transported by phloem to the various parts of plants. This transport of organic solutes like sugar (sucrose) along with water occurs bidirectionally and multidirectionally

233 **(d)**
In facilitated diffusion, the rate of diffusion is affected by the solubility of molecules in lipids, concentration gradients, molecular size of the molecules, etc. Availability of carrier molecules also affects the rate of diffusion in facilitated transport

234 **(c)**
Term DPD (Diffusion Pressure Deficit) was coined by Meyer

235 **(d)**
Transpiration, tension, cohesion and adhesion are those factors, which plays an important role in upward movement of xylem sap in plants. Transpiration exerts transpiration pull. Due to cohesion force, water molecules in water column are joined to each other. Adhesion force between the walls of tracheary element and water

molecule produce surface tension, which accounts for high capillarity through tracheary elements. While plasmodesmata are bridge-like structures, which join adjacent cells in symplastic movement of water

236 **(c)**

The rate of diffusion of a substance along the concentration gradient does not increase continuously. While the concentration difference of the molecules across the membrane increases when the process is of carrier type.

This happens because after a certain level, the carrier protein gets saturated

237 **(d)**

According to pressure flow hypothesis, sieve tube system show better adaptation for mass flow of organic nutrients. Due to the process of photosynthesis, source region is always rich in osmotic concentration. So, they pass organic nutrient into sieve tube by active process which in turn produce high osmotic concentration in sieve tube.

Sieve tube absorbs water from adjacent xylem and develop a gradient of turgor pressure. Now, the organic nutrients are transported from an area of higher turgor pressure to the region of lower turgor pressure (sink or utilisation site)

238 **(b)**

It is due to choking of roots by water logging. It is called flopping

239 **(a)**

Graham's law of diffusion can be represented by the following formula

$$\text{Rate of diffusion} \propto \frac{1}{\sqrt{\text{Density of particle}}}$$

240 **(d)**

Cohesion theory or transpiration pull theory for the ascent of sap in plants, was given by **Dixon** and **Jolly** (1894).

241 **(b)**

Sodium, which is essential for animals is not required by most of the plants.

**Water potential** is the difference between the free energy of water in a system and free energy of pure water at atmospheric pressure. The water potential of root cells is lower than the water potential of soil.

**Cohesion-tension** or **transpiration pull theory** is the most accepted theory of water movement in plants.

242 **(d)**

Apoplast pathway consists of interconnecting cell wall, intercellular spaces, cell wall of endodermis excluding the casparian strips, xylem and tracheary elements. This system is considered non-living and is continuous throughout the plant. Symplast pathway consists of the living parts of the plant and is made up of interconnected protoplast adjacent cells

243 **(d)**

$\Psi_w$

244 **(d)**

Water potential is the difference in the free energy or chemical potential per unit molal volume of water in a system and that of pure water at the same temperature and pressure. It is represented by greek letter $\Psi$ (psi) or more accurately $\Psi_w$

Water potential or $\Psi_w$ is the sum total of $\Psi_s$ and $\Psi_p$.

$$\Psi_w = \Psi_s + \Psi_p$$

Where, $\Psi_s \rightarrow$ solute potential

$\Psi_p \rightarrow$ pressure potential

245 **(a)**

In water conducting tissues, tertiary wall is represented by swollen nodules.

246 **(d)**

Translocation of organic nutrients by phloem can be explained accurately by pressure flow model of Munch. According to the model, the source region always shows higher osmotic concentration. Sieve tube with loaded organic food absorb water from nearby xylem and develop a higher turgor pressure. Movement of organic food occur from an area of higher turgor pressure to a region of lower turgor pressure

247 **(a)**

A little amount approximately around 0.2% of absorbed water by plant is used in process of photosynthesis

248 **(a)**

**Transpiration pull** and **cohesion-tension theory** of ascent of sap was proposed by **Dixon** and **Jolly** (1894). The molecules of water show cohesion and molecule of water

and vessel wall show adhesion. Due to these forces water column does not break and pulled upward by the force called **transpiration pull.** The transpiration pull is developed due to transpiration.

250 **(c)**
**Field capacity** is generally defined as 'the water content of an undisturbed soil' after it is saturated by rainfall and drainage of gravitational water has completely stopped.

251 **(b)**
Active transport is a fast process comparative to passive transport and it occurs against the concentration gradient, *i.e.,* material substances are transported from a region of lower concentration to higher concentration. While in diffusion, transport of substances occur along the concentration gradient

252 **(a)**
In mycorrhizal association, a large number of fungal hyphae are associated with the roots of higher plants in which hyphae extend to sufficient distance into soil and have a large surface area. These hyphae absorb water and mineral from the soil and pass them to roots. Roots provide sugar and nitrogen compound to the fungal hyphae

253 **(a)**
Active transport of solute occurs against the concentration gradient of potential gradient, *i.e.*, movement of solute takes place from a lower chemical concentration to higher chemical concentration. That is why, it is also considered as uphill transport

254 **(d)**
Transport processes, facilitated diffusion and active transport are selective and specific because cells are allowed to select substances for uptake. Facilitated diffusion does not support uphill transport of substances, does not support uphill transport of substances, does not require ATP energy and movement of transport proteins are present

255 **(a)**
Ascent of Sap in plants was demonstrated by Girdling experiement. In this experiment, the cortex and phloem of a plant are removed. Due to which, conduction of food towards the cortex is stopped and conduction of water towards the stem by xylem remain unaffected i.e., ascent of sap occurs. For sometime, plant may survive, but after a period it dies due to the absence of sugar in root cells.

256 **(b)**
The value of water potential is always negative or less than zero. Water potential of a solution is determined by using pure water as the standard of reference, which has zero water potential at normal temperature and pressure.
The presence of solute particles reduce free energy of the water. Hence, it decreases the water potential in negative value. So, water potential of a solution is always less than zero

257 **(a)**
Loss of water in liquid phase from the margin and tips of leaves in many herbaceous plant is referred to as guttation. Bergerstein first studied the phenomenon of guttation in 1887. Guttation is not observed in all plants, it is observed in cereals like wheat, maize, oat, etc.

258 **(b)**
Hollard is the amount of total water present in soil. Chresard is the amount of water, which cannot absorbed by the plants.
Thus, Hollard=Chresard+Echard
Or Chresard=Hollard-Echard

259 **(b)**
The cell will decrease in size due to exosmosis.

260 **(a)**
The loss of water from the living tissue of aerial parts of plant in the form of water vapour is called **transpiration**. More than 95% of total loss of water takes place through stomata. Opening and closing of stomata occurs due to turgor change in guard cells.

261 **(d)**
The water moves from lower DPD to higher DPD.

262 **(a)**
Plasmolysis is the phenomenon of shrinkage of protoplasm from the cell wall due to exosmosis of under the influence of some hypertonic solution (i.e., a solution of lower water potential than the cell's water potential).

263 **(d)**

The stomatal movement is affected by many factors like light, temperature, $CO_2$ concentration, water deficit, turgor pressure, growth hormone, atmospheric humidity, etc.

264 **(c)**
The water potential ($\Psi_w$) in a plant cell or tissues is equal to the algebraic sum of solute potential ($\Psi_s$) due to dissolved solutes and the pressure potential ($\Psi_p$) due to pressure developed within the cells or issues, i.e., $\Psi_w = \Psi_s + \Psi_p$.

265 **(d)**
According to mass-flow hypothesis, there is a mass flow of mineral ions into the root along with transpiration current. Actually, transpiration creates a suction pressure or transpiration pull, conveyed from leaf xylem to root hair, which causes absorption of water from the soil passively. A large amount of ions are also absorbed along with the absorption of water. When the rate of transpiration is high, absorption of water increases due to increased suction pressure and along with water, absorption of ions also increases.

266 **(c)**
Both phenyl mercuric acetate (PMA) and abscisic acid (ABA) act as antitransirants.

267 **(b)**
The vertical conduction of water from root to aerial parts of plant is called **ascent of sap**. The water molecules remain joined to each other due to a force of attraction called **cohesion force**. Attraction between water molecules and the walls of xylem is due to adhesion force. These factors help to ensure the continuity of water column in xylem.

268 **(b)**
In the process of diffusion, electrical charges of diffusing substances, *i.e.*, +ve charge, affects the rate of diffusion. Channel protein allows diffusion of solute or substance of appropriate size, *i.e.*, rate of diffusion also affected by molecular size of diffused materials and solubility of diffusing substances. In lipids these is another factor that affects the rate of diffusion

269 **(d)**
**Cohesion-tension theory** for ascent of sap was originally proposed by **Dixon** and **Jolly** (1894) and greatly supported and elaborated by **Dixon** (1914, 1924). It is also called transpiration pull theory and is based on the assumptions of:

3. Continuous water column from rot hairs to the tip of the plant.
4. Cohesive and adhesive properties of water molecules.
5. Strong transpiration pull exerted by all the transpiring leaves on the stem.

270 **(a)**
According to active $K^+$ theory of Levitt, opening of stomata occurs due to influx of $K^+$into guard cells. The source of $K^+$ions are nearby subsidiary and epidermal cells.

271 **(b)**
Decrease in $CO_2$ concentration and less $H^+$ ion concentration is responsible for opening of stomata.

272 **(a)**
The most accepted theory of ascent of sap is **transpiration pull theory** or **cohesion-tension theory** proposed by **Dixon** and **Jolly** (1894). This theory states that water forms a continuous column from root to leaf through xylem ducts. The loss of water from mesophyll by transpiration creates transpiration pull or tension which is transmitted downwards. The column of xylem resists breaking due to force of cohesion between water molecules and adhesion between water and the wall.

273 **(b)**
Cohesion tension theory or transpiration pull was proposed by Dixon and Jolly. Cohesion force is responsible to produce continuous water column in tracheary elements while the force of adhesion between the cells of tracheary elements and water molecule produce surface tension that accounts for high capillary through tracheary elements. Loss of water from aerial parts through transpiration causes a suction pressure in the

water column of plants and this is known as transpiration pull

274 **(a)**
In potato type plant leaf, stomata are more on the lower surface than the upper surface, e.g., potato, pea, tomato, etc.

275 **(c)**
When a plant is placed in pure water, the water will move into the cell until the pressure potential and osmotic potential of the cell become equal

276 **(a)**
Lenticels are small regions on bark and bear small, loosely arranged non-chlorophyllous parenchyma cells called **complementary cells.**

277 **(c)**
Cell membrane possesses certain pores, which are known as porins. These porins are known as transporter protein and is of two types, carrier proteins and channel proteins
Carrier proteins bind to the particular solute, which has to be transported, while channel proteins are usually gated and allows solute of a particular size to pass through

278 **(b)**
In active transport, the movement of solutes occur against the concentration gradient or chemical potential gradient with the expenditure of energy

279 **(b)**
In symplast pathway, the movement of water from soil to xylem channels takes place from cell to cell. The cytoplasm of adjacent cells are connected through plasmodesmata and therefore water moves from one cell to next cell in symplast movement

280 **(d)**
Passive absorption of water by root system is the result of tension on the cell sap in water column of xylem. It develops due to transpiration.
Absorption of ions from soil can be by active and passive transport. $C_4$ photosynthetic system is found in number of tropical plants, both monocots and dicot like maize, sugarcane sorghum, *Amaranthus* etc. They are called $C_4$-plant because the first stable photosynthetic product produced is oxalo acetic acid (4 carbon compound)

281 **(d)**
According to active $K^+$ theory of Levitt, opening of stomata occurs due to influx of $K^+$ into guard cells. The source of $K^+$ ions are nearby subsidiary and epidermal cells. The stomatal closure is considered to be brought about by exertion of $K^+$ and $Cl^-$ from the guard cells to epidermal tissue.

282 **(b)**
Excessive loss of water from the aerial parts of plants causes a tension in whole water column of the plant. As this tension develops due to transpiration, it is also called as transpirational pull. Transpirational pull is also called as cohesion-theory. This theory was proposed by Dixon and Jolly and at present it is most acceptable theory for ascent of sap

283 **(d)**
**Levitt** (1974) proposed the proton transport concept to explain the mechanism of opening of stomata uptake of $K^+$ takes place. The uptake of $K^+$ is balanced by $Cl^-$ uptake. The malic acid dissociate into hydrogen and malate ion. The synthesis of malic acid in guard cells accompanies the influx of potassium ions.

284 **(b)**
Transpiration is the manifestation of turgor pressure. More than 95% of total loss of water occur through stomata of leaves and the mechanism of closing and opening of stomata is regulated by turgidity of guard cells of stomata

285 **(c)**
Distilled water has the highest water potential. The value of water potential is always negative or less than zero. Water potential of a solution is determined by using pure water as the standard of reference, which has zero water potential at normal temperature and pressure.
The presence of solute particles reduce free energy of the water. Hence, it decreases the water potential in negative value. So, water potential of a solution is always less than zero

286 **(b)**
Carbon dioxide is an effective antitranspirant. A little rise in $CO_2$ concentration induces partial closure of stomata. It higher concentration results in complete closure of stomata. Light affects the rate of transpiration in two ways-firstly by controlling the stomatal opening and secondly by affecting

the temperature. Increase in temperature increases the rate of transpiration.

287 **(d)**
During day time, photosynthesis occurs in guard cells because they contain chloroplast. The soluble sugar formed by this process decreases the water potential of guard cells and hence, resulting in stomatal opening.

288 **(b)**
Pure water has maximum diffusion pressure. It solute particles are added in pure water, its diffusion pressure gets lowered and this reduction/decrease in diffusion pressure of water in a solution in reference to its pure state is termed as diffusion pressure deficit

289 **(d)**
When an RBC is kept in hypotonic solution then, water enters the RBC by the process of osmosis (endosmosis). The RBC will increase in size and ultimately burst. Osmosis is the movement of solvent particles from hypotonic to hypertonic medium through semi-permeable membrane.

290 **(d)**
**Atmospheric humidity** reduces the rate of transpiration, when the air is dry, the rate of transpiration increases.

292 **(a)**
Imbibition.
Air dried seeds of pea on coming in contact with water can develop an imbibition pressure, which is mainly responsible for the uptake of water. This leads to changes in the volume of each seed. Thus, the lid tightly put over a tin containing seeds with water will be blown off

293 **(a)**
The turgidity of cell increases, if water enters in a cell. As a result of turgidity, turgor pressure is exerted by its swollen protoplast.

294 **(d)**
Plants can absorb water through their entire surface. However, water is found in the soil and only positively geotrophic part, *i.e.*, root system is specialised to absorb water. In root system, the most efficient region of water absorption is the root hair zone or zone of call differentiation

295 **(d)**
Root pressure, a manifestation of active water absorption is a positive pressure, which develops in the sap of xylem of root of the same plant. It is observed maximum in rainy season in tropical plants and during spring in temperate plants. It is commonly met in plants at around 1-2 atm. It is absent in gymnosperms. Normally observed value of root pressure is not able to raise the level of sap to the top of tree and is only able to raise water level upto or above ground

296 **(a)**
Guttation refers to the exudation of water droplets (in the form of salt solution) from the margin and tips of leaves. Guttation water is exuded from the group of leaf cells through specialised opening or pore structure called hydathodes or water stomata. It occurs in herbaceous plants and in some angiosperms like *Colocasia*, and tomato. It is finally noticed in the morning in cereals like oat, wheat and maize. It takes place when transpiration is suppressed and relative humidity is high, such as during night

297 **(c)**
The value of diffusion Pressure Deficit (DPD) is equal to the difference between the Turgor Pressure (TP) and the Osmotic Pressure (OP) in a solution in the cell or system. In full turgid cell
DPD = OP – WP
Or = OP – TP

298 **(d)**
Transport of organic and inorganic substances in plants over longer distance proceeds through the vascular tissue system, *i.e.*, xylem and phloem and it is called translocation. It occurs through mass flow

299 **(b)**
Casparian strips are located in the wall of endodermal cells. These are made up of lignin and suberin. They prevent and block the movement of water and minerals from one side to the other side *via* cell wall route. So water cannot reach through apoplast but it moves through endodermis by symplastic movement

300 **(d)**
Mass-flow hypothesis was proposed by Munch (1931). According to this, food materials are translocated through phloem along concentration gradient between food material(source) to the site of utilization.

301 **(c)**
Process of diffusion is slow and passive. Diffusion occurs along the concentration gradient and does not need energy. In diffusion, molecules diffuse randomly and the net result being substances moving from a region of higher concentration to a region of lower concentration

302 **(a)**
Movement of water through cell wall is **apoplastic**.

303 **(d)**
Movement of water inside the roots from soil to xylem and then in most of the plant parts takes place by transpiration forces, which provides both energy and necessary pull. Cohesion force is responsible to join the water molecule with one another in water column. While force between tracheary wall and water molecule produces surface tension which accounts high capillarity through tracheary elements. These forces help to ensure the continuity of water column in xylem

304 **(c)**
Short distance transport of substances like gases, mineral water, hormones and nutrients occur through diffusion and by cytoplasmic streaming, supplemented by active transport

305 **(c)**
A. Symplastic path
B. Apoplastic path
C. Endodermis
D. Xylem
E. Cortex
F. Casparian strip
G. Pericycle
H. Phloem

306 **(b)**
This is due to the fact that increased temperature raises the kinetic energy of the system and lower temperature works in the opposite direction

308 **(a)**
The difference between the free energy of water molecule in pure water and the energy of water in any other system (solution or plant tissue) is termed as water potential. Movement of water occurs from region of higher water potential to lower water potential.

$$\Psi_w = \Psi_s + \Psi_m + \Psi_p$$

Where, $\Psi_w$ = water potential, $\Psi_m$ = metric potential
$\Psi_s$ = solute potential and $\Psi_p$ = pressure potential.

309 **(b)**
Hollard is the amount of total water present in the soil. Water amount available to the plants is known as chresard, while echard is the amount of water, which cannot be absorbed by the plants. Therefore, it can be summarised as Hollard = Chresard + Echard

310 **(c)**
The amount by which diffusion pressure of a solution is lower than that of its pure solvent is known as **diffusion pressure deficit**. When water enters into the cell TP increases, turgidity increases and cell wall develops equal and opposite wall pressure. At the state of equilibrium, DPD will become zero.

311 **(a)**
The loss of water from aerial parts of living plants is known as **transpiration**. Transpiration may be stomatal (80-90%), cuticular (3-9%) and lenticular (0.1%). Transpiration remain absent in submerged hydrophytic plants because stomata are completely absent in the leaves of submerged plants, *e.g., Anacharis and Potamogeton*.

312 **(a)**
The value of osmotic potential of an electrolyte will be greater by the degree of its dissociation into ions at a given temperature and dilution over the one calculated by Van't Hoffs formula
$P = CRT \times I$ or ionisation constant

313 **(a)**
Co-transport is a method of transport in which two types of molecule are transported together. It is of two types, symport method and antiport method. In antiport method, the molecules are transported in opposite direction

315 **(d)**
If an external solution balances the osmotic pressure of the cytoplasm, it is known as isotonic solution. When the cells are placed in isotonic solution, there is no net flow of water

316 **(b)**
Diffusion of water from its pure state or dilute solution into a solution or stronger solution,

when the two are separated by semi-permeable membrane is called osmosis. In thistle funnel experiment, when sugar solution is added to beaker after the process of osmosis stops, the solution of beaker becomes hypertonic, as a result of which exosmosis occurs in thistle funnel hence, level of solution in thistle funnel lowers.

317 **(a)**
Cohesion of water and transpiration pull theory for ascent of sap is most widely accepted theory.

318 **(a)**
Osmosis is a special type of diffusion of water molecule from a dilute solution to concentration solution through a differentially or semipermeable membrane

319 **(a)**
Guttation refers to the exudation of liquid drops from margins and tips of the leaves throught specialized structures called hydathodes. The development of root pressure in a plant leads to positive hydrostatic pressure in xylem sap throughout the plants. Because water conducting xylem elements of a vascular bundle terminate in a hydathodes, xylem sap is forced to flow throught the hydathodes. Thus in guttation water is exuded from the leaf.

320 **(b)**
Potometer is used to measure the rate of transpiration and it works on the principle that the amount of water absorbed is equals the amount of water transpired. Transpiration rate is inversely proportional to the relative humidity, *i.e.,* rate to transpiration is lower in higher relative humidity while lower humidity (dry air) increases the rate of transpiration

321 **(a)**
Pea seeds contain protein, while wheat contains starch, the imbibition capacity of proteins is more than that of starch. That is why, pea seeds imbibe more water and show more swelling than those of wheat grains.

322 **(c)**
Cytokinins are the plant hormones which play an important role in the opening of stomata by the exchange of ions (entry of $K^+$ ions into guard cells and exit of $H^+$ ions). Cytokinins are also responsible for the activity of cell division.

323 **(a)**
All the statements are correct except IV. Plasmolysis occurs as simple osmosis process because water moves from higher concentration solution to lower concentration solution

324 **(b)**
To overcome the transport of hydrophilic substances through membranes, cell membrane possess aquaporins or water channels. Water channels have been recorded for passive transport of water soluble substances made up of eight different type of aquaporins

325 **(a)**
Mass flow or pressure flow hypothesis for translocation of organic food was proposed by Munch (1930). According to the hypothesis, organic substances are transported from a higher osmotic pressure to an area of lower osmotic pressure. This occurs due to the development of a gradient turgor pressure. Flow of organic solution takes place from a region of higher turgor pressure (source) to an area of lower turgor pressure (sink) or utilisation site

326 **(b)**
The auxin treated cells shows an increase in their metabolism. Respiration in these cells increases and more of energy is provided for the absorption of water (active absorption)

327 **(d)**
The difference between the diffusion pressure of the solution and its solvents at a particular temperature and atmospheric conditions is called DPD (Diffusion Pressure Deficit). DPD is also known as suction pressure.
In fully turgid cells, turgor pressure is equal to osmotic pressure and hence diffusion pressure deficit becomes zero in such case.

$$OP = TP \text{ (in turgid cell)}$$
$$\therefore \quad DPD = 0 \text{ (zero)}$$

328 **(c)**
Long distance transport of the substances takes place through bulk flow system. Organic nutrients are supplied over long distance transport by phloem tissue from source to sink region. The direction of transport of these organic nutrients

can be upward or downward, *i.e.,* bidirectional. This is due to the variable relationship between synthesis region or source site and sink or utilisation region

329 **(d)**

The cohesion tension theory for ascent of sap (water movement) in plants was proposed by **Henry Dixon** and **Jolly** (1894) and greatly supported and elaborated by **Dixon** (1914, 1924). At present, it is most acceptable theory for ascent of sap, according to which continuous water column, cohesion and adhesion forces and transpiration pull are responsible for movement of water in the xylem.

330 **(d)**

Generally, it is considered that inorganic nutrients are transported by xylem, while phloem takes part in transporting organic nutrient. But same is not true. In xylem sap, nitrogen is also transported as ions, organic form of amino acids etc. So, there is an exchange of even a small amount of material between xylem and phloem. A majority of minerals enter into the root through active absorption as concentration of minerals are more in roots interior then in soil. Relationship between the source and sink is variable and depends upon the season and need of plants

331 **(a)**

Water is a polar molecule and forms hydrogen bonds between the positively charged hydrogen atoms and negatively charged oxygen atom. Hydrogen bonds make water molecules stick together, a process known as cohesion.

When water molecules form hydrogen bonds with other molecules, such as carbohydrates, it is called adhesion. The hydrogen bonds have tension between them. So water molecules stick together and move together