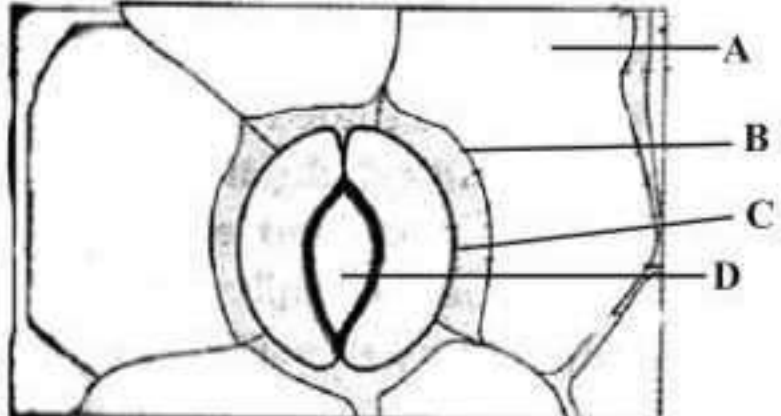


## Chapter 11. Transport In Plants

1. The water potential of pure water is
  - (a) less than zero
  - (b) more than zero but less than one
  - (c) more than one
  - (d) zero. *(NEET 2017)*
2. Which of the following facilitates opening of stomatal aperture?
  - (a) Decrease in turgidity of guard cells
  - (b) Radial orientation of cellulose microfibrils in the cell wall of guard cells
  - (c) Longitudinal orientation of cellulose microfibrils in the cell wall of guard cells
  - (d) Contraction of outer wall of guard cells *(NEET 2017)*
3. A few drops of sap were collected by cutting across a plant stem by a suitable method. The sap was tested chemically. Which one of the following test results indicates that it is phloem sap?
  - (a) Acidic
  - (b) Alkaline
  - (c) Low refractive index
  - (d) Absence of sugar *(NEET-II 2016)*
4. Root pressure develops due to
  - (a) passive absorption
  - (b) active absorption
  - (c) increase in transpiration
  - (d) low osmotic potential in soil. *(2015)*
5. A column of water within xylem vessels of tall trees does not break under its weight because of
  - (a) lignification of xylem vessels
  - (b) positive root pressure
  - (c) dissolved sugars in water
  - (d) tensile strength of water. *(2015)*
6. In a ring girdled plant
  - (a) the shoot and root die together
  - (b) neither root nor shoot will die
  - (c) the shoot dies first
  - (d) the root dies first. *(2015 Cancelled)*
7. Transpiration and root pressure cause water to rise in plants by
  - (a) pushing it upward
  - (b) pushing and pulling it, respectively
  - (c) pulling it upward
  - (d) pulling and pushing it, respectively. *(2015 Cancelled)*
8. Which one gives the most valid and recent explanation for stomatal movement?
  - (a) Starch hydrolysis
  - (b) Guard cell photosynthesis
  - (c) Transpiration
  - (d) Potassium influx and efflux *(2015 Cancelled)*
9. Which of the following criteria does not pertain to facilitated transport?
  - (a) Transport saturation
  - (b) Uphill transport
  - (c) Requirement of special membrane proteins
  - (d) High selectivity *(NEET 2013)*
10. In land plants, the guard cells differ from other epidermal cells in having
  - (a) cytoskeleton
  - (b) mitochondria
  - (c) endoplasmic reticulum
  - (d) chloroplasts. *(2011)*
11. Guttation is the result of
  - (a) diffusion
  - (b) transpiration
  - (c) osmosis
  - (d) root pressure. *(Mains 2011)*
12. Given below is the diagram of a stomatal apparatus. In which of the following all the four parts labelled as A, B, C and D are correctly identified?
 





- |     | A   | B                     | C                     | D                     |  |
|-----|---|-----------------------|-----------------------|-----------------------|--|
|     | (a) Subsidiary cell   | (a) Epidermal cell    | (a) Guard cell        | (a) Stomatal aperture |  |
|     | (b) Guard cell  | (b) Stomatal aperture | (b) Subsidiary cell   | (b) Epidermal cell    |  |
|     | (c) Epidermal cell  | (c) Guard cell        | (c) Stomatal aperture | (c) Subsidiary cell   |  |
|     | (d) Epidermal cell  | (d) Subsidiary cell   | (d) Stomatal aperture | (d) Guard cell        |  |
|     | <i>(Mains 2010)</i>   |                       |                       |                       |  |
| 13. | Guard cells help in   |                       |                       |                       |  |
|     | (a) transpiration   |                       |                       |                       |  |
|     | (b) guttation   |                       |                       |                       |  |
|     | (c) fighting against infection  |                       |                       |                       |  |
|     | (d) protection against grazing. <span style="float: right;"><i>(2009)</i></span>  |                       |                       |                       |  |
| 14. | The rupture and fractionation do not usually occur in the water column in vessel/tracheids during the ascent of sap because of  |                       |                       |                       |  |
|     | (a) weak gravitational pull   |                       |                       |                       |  |
|     | (b) transpiration pull  |                       |                       |                       |  |
|     | (c) lignified thick walls   |                       |                       |                       |  |
|     | (d) cohesion and adhesion. <span style="float: right;"><i>(2008)</i></span>   |                       |                       |                       |  |
| 15. | 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) no movement of water  |                       |                       |                       |  |
|     | (b) equilibrium between the two   |                       |                       |                       |  |
|     | (c) movement of water from cell A to B  |                       |                       |                       |  |
|     | (d) movement of water from cell B to A. <span style="float: right;"><i>(2007)</i></span>  |                       |                       |                       |  |
| 16. | The translocation of organic solutes in sieve tube members is supported by  |                       |                       |                       |  |
|     | (a) cytoplasmic streaming   |                       |                       |                       |  |
|     | (b) root pressure and transpiration pull  |                       |                       |                       |  |
|     | (c) P-proteins  |                       |                       |                       |  |
|     | (d) mass flow involving a carrier and ATP. <span style="float: right;"><i>(2006)</i></span>   |                       |                       |                       |  |
| 17. | Potometer works on the principle of   |                       |                       |                       |  |
|     | (a) osmotic pressure  |                       |                       |                       |  |
|     | (b) amount of water absorbed equals the amount transpired   |                       |                       |                       |  |
|     | (c) root pressure   |                       |                       |                       |  |
|     | (d) potential difference between the tip of the tube and that of the plant. <span style="float: right;"><i>(2005)</i></span>  |                       |                       |                       |  |
| 18. | Stomata of a plant open due to  |                       |                       |                       |  |
|     | (a) influx of potassium ions  |                       |                       |                       |  |
|     | (b) efflux of potassium ions  |                       |                       |                       |  |
|     | (c) influx of hydrogen ions   |                       |                       |                       |  |
|     | (d) influx of calcium ions. <span style="float: right;"><i>(2003)</i></span>  |                       |                       |                       |  |
| 19. | Main function of lenticel is  |                       |                       |                       |  |
|     | (a) transpiration (b) guttation   |                       |                       |                       |  |
|     | (c) gaseous exchange (d) bleeding. <span style="float: right;"><i>(2002)</i></span>   |                       |                       |                       |  |
| 20. | Opening and closing of stomata is due to the  |                       |                       |                       |  |
|     | (a) hormonal change in guard cells  |                       |                       |                       |  |
|     | (b) change in turgor pressure of guard cells  |                       |                       |                       |  |
|     | (c) gaseous exchange  |                       |                       |                       |  |
|     | (d) respiration. <span style="float: right;"><i>(2002)</i></span>   |                       |                       |                       |  |
| 21. | Passive absorption of minerals depends on   |                       |                       |                       |  |
|     | (a) temperature   |                       |                       |                       |  |
|     | (b) temperature and metabolic inhibitor   |                       |                       |                       |  |
|     | (c) metabolic inhibitor   |                       |                       |                       |  |
|     | (d) humidity. <span style="float: right;"><i>(2001)</i></span>  |                       |                       |                       |  |
| 22. | Glycolate induces opening of stomata in   |                       |                       |                       |  |
|     | (a) presence of oxygen  |                       |                       |                       |  |
|     | (b) low CO <sub>2</sub> concentration   |                       |                       |                       |  |
|     | (c) high CO <sub>2</sub>  |                       |                       |                       |  |
|     | (d) CO <sub>2</sub> absent. <span style="float: right;"><i>(2001)</i></span>  |                       |                       |                       |  |
| 23. | Loading of phloem is related to   |                       |                       |                       |  |
|     | (a) increase of sugar in phloem   |                       |                       |                       |  |
|     | (b) elongation of phloem cell   |                       |                       |                       |  |
|     | (c) separation of phloem parenchyma   |                       |                       |                       |  |
|     | (d) strengthening of phloem fiber. <span style="float: right;"><i>(2001)</i></span>   |                       |                       |                       |  |
| 24. | The movement of ions against the concentration gradient will be   |                       |                       |                       |  |
|     | (a) active transport (b) osmosis  |                       |                       |                       |  |
|     | (c) diffusion (d) all of the above. <span style="float: right;"><i>(2000)</i></span>  |                       |                       |                       |  |
| 25. | In soil, water available for plants is  |                       |                       |                       |  |
|     | (a) gravitational water   |                       |                       |                       |  |
|     | (b) chemically bound water  |                       |                       |                       |  |
|     | (c) capillary water   |                       |                       |                       |  |
|     | (d) hygroscopic water. <span style="float: right;"><i>(1999)</i></span>   |                       |                       |                       |  |
| 26. | The water potential and osmotic potential of pure water are   |                       |                       |                       |  |
|     | (a) 100 and 200 (b) zero and 100  |                       |                       |                       |  |
|     | (c) 100 and zero (d) zero and zero. <span style="float: right;"><i>(1998)</i></span>  |                       |                       |                       |  |
| 27. | When a cell is fully turgid, which of the following will be zero?   |                       |                       |                       |  |
|     | (a) Turgor pressure (b) Water potential   |                       |                       |                       |  |
|     | (c) Wall pressure (d) Osmotic pressure <span style="float: right;"><i>(1997)</i></span>   |                       |                       |                       |  |
| 28. | With an increase in the turgidity of a cell, the wall pressure will be  |                       |                       |                       |  |
|     | (a) fluctuate (b) remain unchanged  |                       |                       |                       |  |
|     | (c) increase (d) decrease. <span style="float: right;"><i>(1997)</i></span>   |                       |                       |                       |  |



29. Bidirectional translocation of solutes takes place in  
 (a) parenchyma (b) cambium  
 (c) xylem (d) phloem. (1997)
30. When water enters in roots due to diffusion, is termed as  
 (a) osmosis (b) passive absorption  
 (c) endocytosis (d) active absorption. (1996)
31. The movement of water, from one cell of cortex to adjacent one in roots, is due to  
 (a) accumulation of inorganic salts in the cells  
 (b) accumulation of organic compounds in the cells  
 (c) water potential gradient  
 (d) chemical potential gradient. (1995)
32. Translocation of carbohydrate nutrients usually occurs in the form of  
 (a) glucose (b) maltose  
 (c) starch (d) sucrose. (1993)
33. In guard cells when sugar is converted into starch, the stomatal pore  
 (a) closes completely  
 (b) opens partially  
 (c) opens fully  
 (d) remains unchanged. (1992)
34. At constant temperature, the rate of transpiration will be higher at  
 (a) sea level  
 (b) 1 km below sea level  
 (c) 1 km above sea level  
 (d) 1.5 km above sea level. (1992)
35. Conversion of starch to organic acids is required for  
 (a) stomatal opening  
 (b) stomatal closing  
 (c) stomatal formation  
 (d) stomatal activity. (1992)
36. In terrestrial habitats, temperature and rainfall conditions are influence by  
 (a) water transformations  
 (b) transpiration  
 (c) thermoperiodism  
 (d) translocation. (1992)
37. Guttation is mainly due to  
 (a) root pressure (b) osmosis  
 (c) transpiration (d) imbibition. (1992)
38. Which of the following is used to determine the rate of transpiration in plants?  
 (a) Porometer/Hygrometer  
 (b) Potometer  
 (c) Auxanometer  
 (d) Tensiometer/Barometer (1992)
39. Water movement between cells is due to  
 (a) T.P.  
 (b) W.P.  
 (c) D.P.D.  
 (d) incipient plasmolysis. (1992)
40. The most widely accepted theory for ascent of sap in trees is  
 (a) capillarity  
 (b) role of atmospheric pressure  
 (c) pulsating action of living cell  
 (d) transpiration pull and cohesion theory of Dixon and Jolly. (1991)
41. In soil, the water available for root absorption is  
 (a) gravitational water  
 (b) capillary water  
 (c) hygroscopic water  
 (d) combined water. (1991)
42. The principal pathway of water translocation in angiosperms is  
 (a) sieve cells  
 (b) sieve tube elements  
 (c) xylem vessel system  
 (d) xylem and phloem. (1990)
43. A bottle filled with previously moistened mustard seeds and water was screw capped tightly and kept in a corner. It blew up suddenly after about half an hour. The phenomenon involved is  
 (a) diffusion (b) imbibition  
 (c) osmosis (d) DPD. (1990)
44. Minerals absorbed by root move to the leaf through  
 (a) xylem (b) phloem  
 (c) sieve tubes (d) none of the above. (1989)
45. Stomata open and close due to  
 (a) circadian rhythm  
 (b) genetic clock  
 (c) pressure of gases inside the leaves  
 (d) turgor pressure of guard cells. (1988)



46. Phenyl mercuric acetate (PMA) results in  
 (a) reduced photosynthesis  
 (b) reduced transpiration  
 (c) reduced respiration  
 (d) killing of plants. (1988)
47. Transpiration is least in  
 (a) good soil moisture  
 (b) high wind velocity  
 (c) dry environment  
 (d) high atmospheric humidity. (1988)
48. Water potential is equal to  
 (a)  $\psi_s + \text{O.P.}$   
 (b)  $\psi_s = \text{T.P.}$   
 (c)  $\psi_p + \psi_w$   
 (d)  $\psi_s + \psi_p$ . (1988)

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**Answer Key**


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1. (d) 2. (b) 3. (b) 4. (b) 5. (d) 6. (d) 7. (d) 8. (d) 9. (b) 10. (d)  
 11. (d) 12. (d) 13. (a) 14. (d) 15. (c) 16. (c) 17. (b) 18. (a) 19. (c) 20. (b)  
 21. (a) 22. (b) 23. (a) 24. (a) 25. (c) 26. (d) 27. (b) 28. (c) 29. (d) 30. (b)  
 31. (c) 32. (d) 33. (a) 34. (d) 35. (a) 36. (b) 37. (a) 38. (b) 39. (c) 40. (d)  
 41. (b) 42. (c) 43. (b) 44. (a) 45. (d) 46. (b) 47. (d) 48. (d)
-



## EXPLANATIONS

1. (d)

2. (b) : When turgidity increases within the two guard cells flanking each stomatal aperture or pore, the thin outer wall bulge out and force the inner walls into a crescent shape. This results in the opening of stomata. The opening of stomata is also aided by the radial orientation of cellulose microfibrils in the cell wall of guard cells rather than longitudinal orientation.

3. (b)

4. (b) : Root pressure is positive pressure that develops in the xylem sap of the root of some plants. It is a manifestation of active water absorption.

5. (d) : Cohesion, adhesion and surface tension are the forces responsible for movement of water up the tracheary elements. Water molecules remain attached to one another by a strong mutual force of attraction called cohesion force. On account of cohesion force, the water column can bear a tension or pull of upto 100 atm. Therefore, the cohesion force is also called tensile strength. Its theoretical value is about 15,000 atm but the measured value inside the tracheary elements ranges between 45 atm to 207 atm. Water column does not further break its connection from the tracheary elements because of another force called adhesion force between their walls and water molecules. Another force called surface tension accounts for high capillarity through tracheids and vessels.

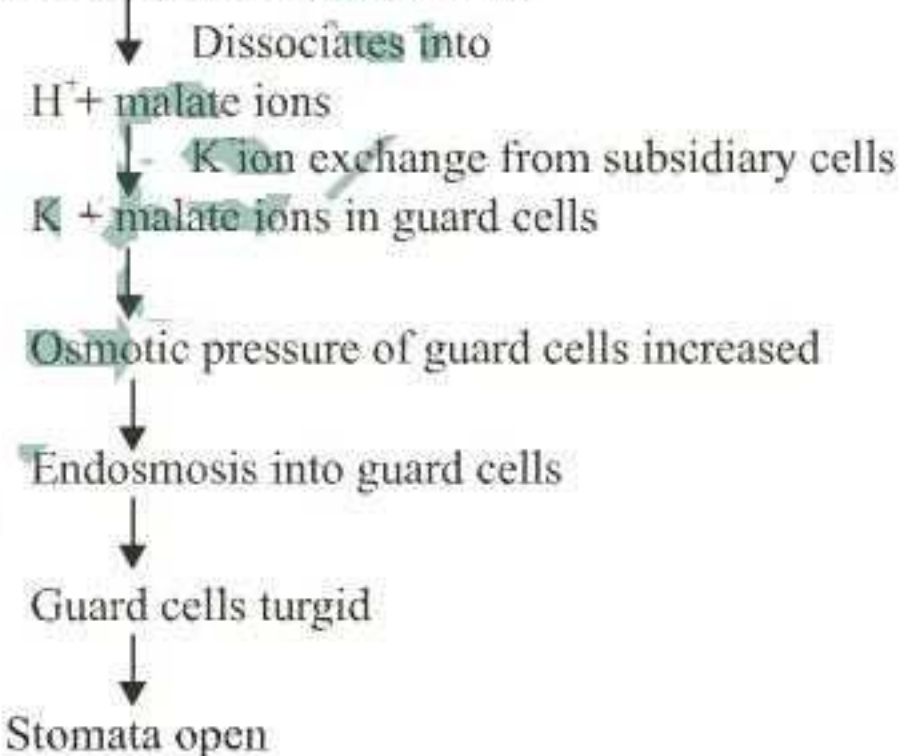
6. (d) : In girdling or ringing experiments, a ring of bark is cut from the stem. It also removes phloem. Nutrients collect above the ring, where the bark also swells up and may give rise to adventitious roots. Growth is also vigorous above the ring. The tissues below the ring not only show stoppage of growth but also begin to shrivel. Roots can be starved and killed, if the ring is not healed after some time. Killing of roots shall kill the whole plant, clearly showing that bark or phloem is involved in the movement of organic solutes towards root.

7. (d) : The transpiration process, pulls water upwards with the help of cohesion and adhesion properties of water molecules. According to transpiration pull theory, due to transpiration, the water column inside the plant comes under tension. This is called 'transpiration pull'. On account of this tension, the water column is pulled up passively from below to top of the plant (almost like a rope). Root pressure is the pressure that forces water, absorbed

from the soil, to move through the roots and up (*i.e.*, pushes it up) the stem of a plant. It may be due to both the osmosis of water from the soil into the root cells, and the active pumping of salts into xylem tissue which maintains a concentration gradient along which the water moves.

8. (d) : According to this theory,  $K^+$  ion enter and accumulate in guard cells during daytime, causing opening of stomata and during night,  $K^+$  ions move out of stomata and stomata closes.

Malic acid is formed in guard cells



9. (b) : Facilitated transport or facilitated diffusion is the spontaneous passage of molecules or ions across a biological membrane passing through specific transmembrane integral proteins. Facilitated diffusion is mediated by protein channels and carrier proteins. Most transport proteins that mediate facilitated diffusion are very selective and only transport certain molecules. The major classes of proteins involved in facilitated diffusion are aquaporins, ion channels, and carrier proteins. Importantly, neither channels nor carrier proteins require energy to facilitate the transport of molecules; they enable molecules to move down their concentration gradients (downhill transport).

10. (d) : The leaf and stem epidermis is covered with pores called stomata (sing., stoma), part of a stoma complex consisting of a pore surrounded on each side by chloroplast-containing guard cells, and two to four subsidiary cells that lack chloroplasts. The guard cells differ from the epidermal cells in the following aspects:

- The guard cells are bean-shaped in surface view, while the epidermal cells are irregular in shape.
- The guard cells contain chloroplasts, so they can manufacture food by photosynthesis (The epidermal cells do not contain chloroplasts).



- Guard cells are the only epidermal cells that can synthesis sugar.

**11. (d) :** Various ions from the soil are actively transported into the vascular tissues of roots, water follows its potential gradient and increase the pressure inside the xylem. This positive pressure is called root pressure.

Effect of root pressure is observable at night and early morning when evaporation is low and excess water collects in the form of droplets near the tip of leaves of many herbaceous plants. Such water loss in its liquid phase is known as guttation.

**12. (d) :** A – Epidermal cell  
B – Subsidiary cell  
C – Stomatal aperture  
D – Guard cell

**13. (a) :** Stomata are the main organs for transpiration. The stem and leaf epidermis are provided with numerous stomata. Diffusion of water vapour through the stomatal pores is known as stomatal transpiration. Transpiration occurs while the stomata are open for the passage of carbon dioxide and oxygen during photosynthesis. Stomatal opening and closing is regulated by the movement of guard cells.

**14. (d) :** Refer to answer 5.

**15. (c) :** Diffusion pressure deficit is the reduction in the diffusion pressure of water in a system over its pure state. It is given by  $DPD = O.P - W.P$  (T.P). DPD determines the direction of net movement of water. It is always from an area or cell of lower DPD to the area or cell of higher DPD. So, cell A having lower DPD, water will move from cell A to B.

**16. (c) :** P-proteins (Phloem proteins) are components found in large amounts in phloem sieve tubes.

The main function of these bodies is to seal off the sieve tube element or sieve cell by bringing about the blockage of sieve plate. These bodies perform this function when the sieve element is injured. These bodies and callose together block the pores of sieve tube elements. P-protein bodies and callose form blocking plugs. These bodies remain along the walls of sieve tube elements. P-protein bodies are assigned some in the translocation of food material in the sieve tubes but is not universally accepted.

**17. (b) :** Potometer is an instrument or apparatus with the help of which, rate of transpiration can be measured. Main types of potometers are as under: Simple potometer, Farmer's potometer and Ganong's potometer.

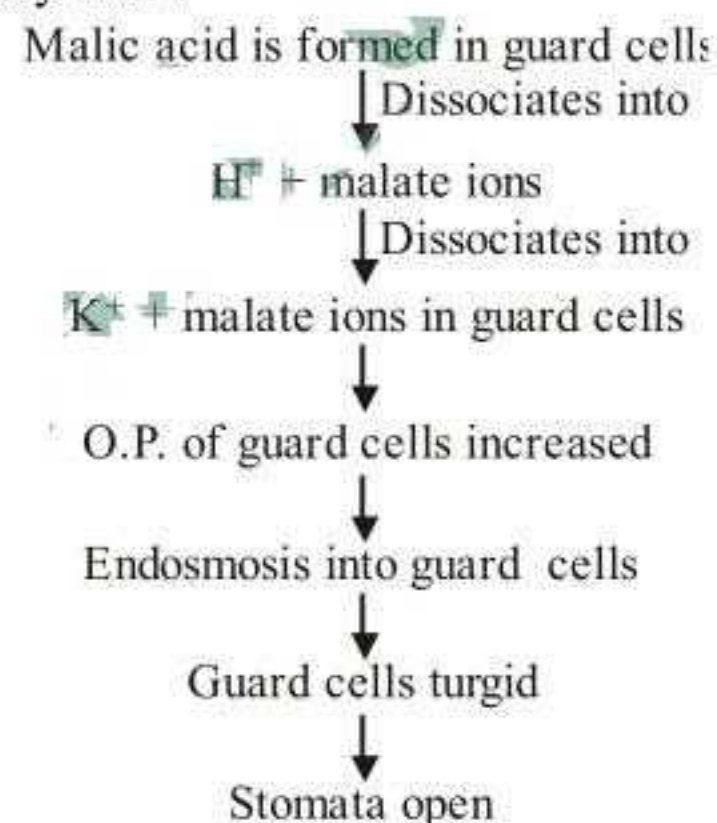
The whole instrument is made of glass and is consisted of a long tube, having a side tube, bent at right angles.

A fresh plant shoot is cut under water and is inserted into the side tube through a cork, fitted into the mouth of this tube. The whole apparatus is filled with water and the joints are made air tight.

The apparatus is placed in the sunlight. Air bubble enters the tube and after this lower end of the tube is placed in the beaker, containing water. Water is absorbed by the shoot and is transpired through the leaves. Transpiration pull is created and the air bubble begins to move along with the transpiration pull. Readings are taken for the air bubble and thus amount of water absorbed and transpired is calculated.

**18. (a) :** The mechanism of opening and closing of stomata is explained by active  $K^+$  ion transport theory.

During day time :



During night or dark :  $CO_2$  conc. increases in sub-stomatal cavities  $\square$  ABA participation  $\square$   $K^+$  ions exchange stopped  $\square$   $K^+$  ions transported back into subsidiary cells  $\square$  Decreased pH  $\square$  Starch synthesized in guard cells  $\square$  Decreased O.P. of guard cells  $\square$  Exosmosis from guard cell  $\square$  Stomata close.

**19. (c) :** Lenticels generally appear under stomata. The lenticel of phellogen itself also has intercellular spaces. Because of this relatively open arrangement of cells, the lenticels are regarded as structures permitting the entry of air through the periderm.

Lenticels are characteristics of woody stem but they are also found in roots of trees and other perennials for entry of oxygen through them.

**20. (b) :** Refer to answer 18.

**21. (a) :** Rate of salt absorption increases when temperature increases but to a certain limit as salt absorption is inhibited at higher temperature because certain enzymes are not active at higher temperature and carriers are not synthesised. These carriers are required for active transport of salts from outer space in inner space.



Rate of diffusion of ions and molecules increases at enhanced temperature due to their increased kinetic activity. Thus passive salt absorption will increase.

**22. (b) :** Zelitch (1963) suggested that glycolic acid is formed in the guard cells. This acid is formed under low concentration of  $\text{CO}_2$ . Glycolate formed gives rise to carbohydrates. Under this condition, osmotically active material is produced and ATP synthesis also takes place. ATP is produced during glyoxylate-glycolate shuttle. This ATP helps in the active pumping of water in the guard cells and stomata open. Stomata close when this process is reversed.

**23. (a) :** When the phloem cells, just near the source, for example green leaves attain higher concentration of sugars, it is called the process of phloem loading. Sucrose is photosynthesised in the chloroplasts of mesophyll cells of leaves. Mesophyll cells are connected with each other through plasmodesmata. Similarly plasmodesmata are also present between the mesophyll cells and companion cells and also between mesophyll cells and sieve tubes. These plasmodesmata are the "channels" meant for the passage of sucrose.

**24. (a) :** Active transport involves movement of materials across the membrane against the concentration gradient of the solute particles. It requires energy in the form of ATP and carrier molecules.

**25. (c) :** Water occurs in the soil in the different forms as: free water, gravitational water, hygroscopic water, chemically combined water and capillary water. Free water is that water which runs away and is not held by the soil. Obviously it is not available to the plants. Gravitational water goes down into the deeper strata of earth and it is also not available to the plants. Hygroscopic water is present in the form of thin films around the soil particles and it is also not available to the plants under normal condition but it may be available under adverse conditions. Chemically combined water is not available to the plants at all. The only water which is available to the plants is capillary water. Capillary water makes up about 75% of the total water available to plants. The rest of soil water (hygroscopic, combined, free, gravitational and 25% capillary water) are not available to plants. These are called *hard* or unavailable water.

**26. (d) :** Water potential or chemical potential in pure water is zero bar, arbitrarily. Osmotic potential or solute potential represents the effect of dissolved solutes on water potential. Solutes reduce the free energy of water by diluting the water. The osmotic potential of pure water is zero. If solutes are added to water its potential becomes less than that of pure water and is expressed as a negative value.

**27. (b) :** In a full turgid cell,  $\text{DPD} = 0$  because it has  $\text{T.P.} = \text{O.P.}$  It means that the cell has no further capacity to absorb any water. Water potential is equal but opposite in sign to DPD. So in a fully turgid cell the water potential is zero.

**28. (c) :** When a cell is placed in a hypotonic solution then endosmosis occurs it means water enters in the cell and makes the cell turgid. This entry of water in the cell develops in a cell turgor pressure, which exerts pressure on the cell membrane or on the cell wall. If the cell wall is absent as is the case in animal cells then the cells burst due to turgor pressure. But in case of plant cells, wall is present to counteract the turgor pressure. This prevents the plant cells from bursting in a hypotonic solution.

**29. (d) :** The movement of organic food or solute in soluble form from one organ to another organ is called translocation of solutes, e.g., from leaves to stem and roots for consumption.

The movement of organic material is bidirectional. Because xylem is responsible for upward movement of water and minerals, so it cannot account for downward translocation of solute at the same time. Cortex and pith are not structurally suitable for this purpose. Thus only phloem is left where there is end to end arrangement of sieve tubes united by sieve pores which is responsible for translocation of solutes in both direction.

**30. (b) :** Water is absorbed from soil by root system and mainly by root tips. There are two independent mechanisms of water absorption in plants active water absorption and passive water absorption. In active water absorption water is absorbed by the activity of the root itself. In passive water absorption transpiration pull is responsible for absorption of water.

According to this theory loss of water from mesophyll cells of leaves in transpiration decreases their TP and hence increases their DPD or SP. As a result of their increased DPD, they absorb water from adjacent xylem vessels of leaves. This xylem of the leaves is in continuation with xylem of stem and roots and hence this pull is transmitted downwards. The pull or tension is removed only when water is absorbed through root hair and this is passive water absorption. Thus transpiration pull is responsible for passive water absorption.

**31. (c) :** Movement of water always occurs from low DPD to high DPD. During water absorption by roots, water as well as solutes enter through root hair. After absorption of water by root hair, its TP is increased and thus DPD or SP is decreased. Then water from



root hair moves to the cells of the cortex along the concentration gradient and finally reaches the xylem.

**32. (d) :** Translocation of carbohydrates, nutrients usually occurs in the form of sucrose through sieve tube of phloem. Starch is converted to soluble sucrose form.

**33. (a) :** In guard cells when sugar is converted into starch, the stomatal pore closed completely. At night time, the  $\text{CO}_2$  released during respiration accumulates. As a result, the acidity of the guard cells increases and pH decreases. The decreased pH favours conversion of sugar to starch. Pressure of the guard cells falls and hence they become flaccid. As a result, stomatal aperture closes.

**34. (d) :** At constant temperature, the rate of transpiration will be higher at 1.5 km above the sea level. At lower atmospheric pressure there is increase in the rate of evaporation.

**35. (a) :** There is evidence to believe that besides organic acids the turgidity of guard cells is usually controlled by  $\text{K}^+$ ,  $\text{Cl}^-$  and  $\text{H}^+$ . The opening of stomata is initiated by exertion of  $\text{H}^+$  by guard cells, intake of  $\text{K}^+$  and  $\text{Cl}^-$ , disappearance of starch and appearance of organic acids like malic acid.

**36. (b) :** In terrestrial habitats, temperature and rainfall conditions are influenced by transpiration. The rate of transpiration is directly proportional to the saturation deficit of atmosphere. Plants growing in region where transpiration is meagre do not show over heating. So transpiration prevents overheating.

**37. (a) :** The loss of water through water stomata (hydathodes) is called as guttation. Guttation occurs when transpiration rate is very low as compared to rate of water absorption, due to this, root pressure is developed and water is pushed out through specialized pores at vein endings called hydathodes. Therefore guttation is not due to the activity of hydathodes but due to root pressure.

**38. (b) :** Refer to answer 17.

**39. (c) :** Water movement between cells is due to DPD. If a cell is placed in pure water it shows endosmosis and as a result water enters into the cell. Thus, the osmotic entry of water is due to high osmotic pressure of the cell sap. The inward movement of water is, therefore due to the fact that its  $\text{OP} > \text{TP}$ . The net force with which water is drawn into a cell is equal to the difference of OP and TP, known as diffusion pressure deficit.  $\text{DPD} = \text{OP} - \text{TP}$ .

**40. (d) :** Transpiration pull cohesion theory for ascent of sap in trees is most widely accepted. This concept

was proposed by Dixon and Jolly, 1884. It is based up on three basic assumptions which are cohesion in between water molecules, continuity of water column and transpiration pull.

**41. (b) :** Refer to answer 25.

**42. (c) :** The principal pathway of water translocation in angiosperms is xylem vessel system. The sap (*i.e.*, water with dissolved minerals) is absorbed mainly by roots and is moved upward to all the parts of plants via stem. It occurs mainly through xylem.

**43. (b) :** A bottle filled with previously moistened mustard seeds and water was screw capped tightly and kept in a corner. It blew up suddenly after about half an hour due to phenomenon of imbibition. The absorption of water by the solid particles of an adsorbent causing it to enormously increase in volume without forming a solution is called imbibition.

**44. (a) :** Minerals absorbed by roots move to the leaf through xylem. Xylem plays an important role in conduction of water. Hence, when water moves upward through xylem, minerals are also absorbed by the roots and move towards leaves through xylem only. This is known as ascent of sap.

**45. (d) :** The pressure that develops in a cell due to osmotic diffusion of water inside it, is called turgor pressure. Stomata open and close due to turgor pressure of guard cells. When turgid, they swell and bend outward. As a result, the stomatal aperture opens. When they are flaccid, the tension from the wall is released and the stomatal aperture closes.

**46. (b) :** Phenyl mercuric acetate (PMA) results in reduced transpiration. PMA is an antitranspirant. These are some chemicals whose limited application on the leaf surface reduces or checks transpiration. A good antitranspirant increases leaf resistance but does not affect the mesophyll resistance.

**47. (d) :** Transpiration is least in high atmospheric humidity. The rate of transpiration is directly proportional to the saturation deficit. In other words, transpiration rate depends upon the gradient of vapour pressure. Hence, at high atmospheric humidity transpiration rate is low.

**48. (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.

Water potential is represented by Greek letter  $\psi$  (psi) or  $\psi_w$ . Water potential is the sum total of  $\psi_s$  and  $\psi_p$ . Therefore,  $\psi_w = \psi_s + \psi_p$ .

