

## TOPIC: TRANSPORT IN PLANTS

Time: 2 ½ hours

Attempt all questions in this paper

SECTION	MARKS
A	
B	
TOTAL	

### SECTION A (40MARKS)

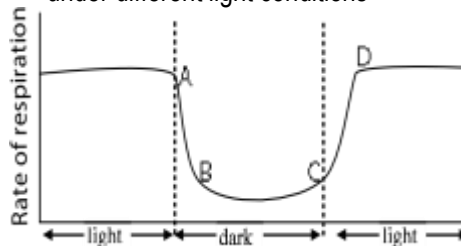
- Which one of the following types of plant is likely to have the thinnest leaf cuticle?
  - Mesophytes
  - halophytes
  - hydrophytes
  - xerophytes
- Sucrose is the major transport solute in plants because is
  - highly soluble so can be transported in high concentration in the sap
  - can easily convert into glucose and fructose
  - insoluble so it cannot be used in chemical reaction
  - can be oxidized by the living parts of the phloem
- Which of the following sets of conditions in the guard cells would lead to the opening of the stomata?
  - High carbon dioxide concentration and low sugar concentration
  - low carbon dioxide concentration and high sugar concentration
  - High sugar concentration and high carbon dioxide concentration
  - Low pH and high starch concentration
- Which one of the following structures are characteristic of a floating plant?
  - Light, thin leaves with hairy surface.
  - broad, thick leaves with thin cuticle
  - Light, thin leaves with thick cuticle
  - broad, thin leaves with aerenchyma
- Which one of the following parts would show a distinct blue color if a section of a root of dicotyledonous plant was stained with iodine?
  - Pericycle
  - Piliferous layer
  - Endodermis
  - Pith
- A companion cell has a large nucleus because
  - it supports the sieve tube element which lacks a nucleus
  - it controls a large volume of cytoplasm
  - movement of materials in sieve tubes is an active process.
  - of its high metabolic rate
- If a metabolic poison was taken up by a plant, which one of the following processes would be affected immediately?
  - Evaporation of water from leaf surfaces.
  - Movement of food from leaves to roots.
  - Movement of water within the stem.
  - Movement of water within leaves.
- Stomatal closure occurs when
  - The turgor in guard cells rises
  - The pH in the guard cells decreases
  - The osmotic potential in the guard cells is more than that in surrounding cells
  - Starch in the guard cells is converted to sugars
- Which one of the following parts would show a distinct blue color if a cross section of a dicotyledonous plant was stained with iodine solution?
  - Pericycle
  - Piliferous layer
  - Endodermis
  - pith
- The path way which allows water to move from cell to cell through the cytoplasm is the
  - apoplast
  - vacuolar
  - Symplast
  - cuticular
- Which of the following does not contribute to the movement of water from the root system to the leaves in a flowering plant?
  - Root pressure
  - Cohesion forces
  - Transpiration pull
  - Atmospheric pressure
- Which one of the following is the main form of photosynthetic product transported by the phloem?
  - Starch
  - Amino acid
  - Sucrose
  - Glucose
- During the heat of the day, control of stomatal movements to reduce excessive water loss is due to
  - Active accumulation of mineral ions in the guard cells
  - Synthesis of abscisic acid
  - Inter-conversion of glucose and starch in the guard cell
  - Synthesis of glucose during photosynthesis.
- If the rate of transpiration lags behind that of absorption, movement of water up the plant is mainly by
  - Root pressure
  - Capillarity
  - Mass flow
  - Transpiration
- A column of water in the xylem vessel of a tall tree ascends without breaking mainly due to
  - Root pressure

- B. Cohesive forces
- C. Transpiration pull
- D. Adhesive force

16. Under which of the following conditions would transpiration be most rapid?

- A. Dark and windy
- B. Light and windy
- C. Dark and still
- D. Light and still

17. The figure shows the rate of transpiration of hibiscus shoot under different light conditions



From the graph at which of the stages indicated did the stomata begin to open? Which one of the following occurs as a result of low pH in the guard cells?

- A. Conversion of sugar to starch, reducing osmotic pressure
- B. Conversion of starch to sugar, reducing osmotic pressure
- C. Conversion of sugar to starch, increasing osmotic pressure
- D. Conversion of starch to sugar, increasing osmotic pressure

18. Which one of the following adaptation helps a desert succulent plant to reduce water loss?

- A. Possess deep roots
- B. Has reduced number of stomata
- C. Possess extensive roots
- D. Sheds its leaves during dry season

19. Which of the following does not involve mass flow?

- A. Blood flow in the arteries
- B. Uptake of food by the tapeworm
- C. Movement of food and water in the gut
- D. Transport of water and mineral salts by the xylem

20. Which of the following qualities of the guard cells least contribute to their opening?

- A. Uneven thickened walls
- B. Inner walls being less elastic than outer walls
- C. Presence of chloroplast
- D. Presence of vacuoles

21. Failure to synthesize abscisic acid in plants may lead to

- A. Leaves turning yellow
- B. Plant drying up
- C. Leaves becoming salty
- D. Poor development of leaves

22. Which one of the following best describes the transport of photosynthetic products in a plant?

- A. Active transport
- B. Osmotic movement
- C. Mass flow
- D. Cytoplasmic streaming

23. Which one of the following pairs of animals have incomplete double circulatory system?

- A. Rabbit and toad
- B. Toad and lizard
- C. Pigeon and monkey
- D. Snake and whale

24. Which one of the following changes bring about the opening of stomata in plant leaves?

- A. Fall in the pH of the intercellular spaces
- B. Synthesis of starch
- C. Rise in levels of carbon dioxide in intercellular spaces
- D. Conversion of starch to sugar

25. Plants growing in humid habitat lose water by

- A. Transpiration
- B. Cuticular transpiration
- C. Guttation
- D. evaporation

26. Stomatal closure occurs when

- A. turgor in the guard cells rises.
- B. the pH in the guard cells decreases.
- C. the osmotic potential in the guard is more than that in surrounding cells.

D. starch in the guard cells is converted to sugar.

27. Figure 2 shows a section of a structure a plant tissue.



The tissue with such a structure is the

- A. collenchyma.
- B. parenchyma.
- C. phloem.
- D. xylem.

28. Besides the root tip, with other part of the root stains deep blue with iodine?

- A. Vascular tissue
- B. Endodermis
- C. Piliferous layer
- D. Root hair

29. During germination, seeds initially absorb water by

- A. Endosmosis
- B. Exosmosis
- C. Plasmolysis
- D. Imbibition

30. Which of the following is not concerned with movement of materials in and out of the cells?

- A. Osmosis
- B. Diffusion
- C. Active transport
- D. Transpiration pull

31. The hydrostatic pressure developed in solution when it is separated from pure water by a semi-permeable membrane in a rigid vessel is called.

- A. Wall pressure
- B. Imbibition pressure
- C. Osmotic pressure
- D. Diffusion pressure.

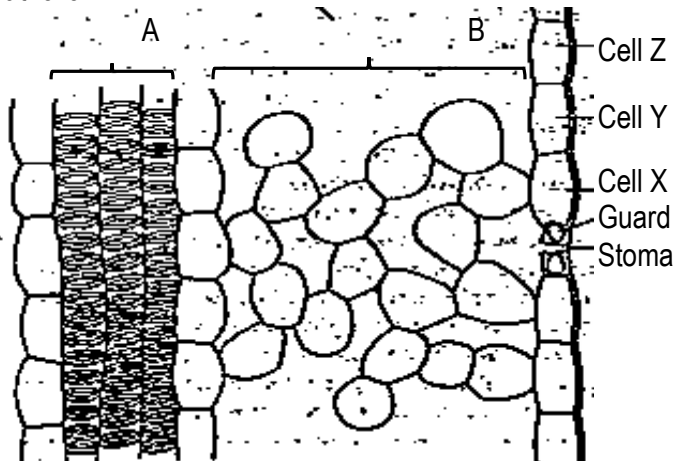
32. A cell is plasmolyzed after being kept in a hypertonic solution, what will be present between the cell wall and plasmalemma

- A. Isotonic solution
- B. Hypertonic solution
- C. Air
- D. Hypotonic solution

33. If turgor pressure becomes equal to wall pressure, then.
- Water leaves the cell
  - Water enters the cell
  - No exchange of water takes place.
  - Solute goes from the cell in to water.
34. A soil is said to be physiologically dry when it has no
- Capillary water
  - Hygroscopic water
  - Combined water
  - Enough salts
35. The most widely recommended explanation for the ascent of sap is
- Capillarity
  - Pulsatory activity of living cells
  - Role of atmospheric pressure
  - Transpiration pull cohesion theory.
36. Stomata in angiosperms open and close due to
- Their genetic constitution
  - Effect of hormones
  - Change of turgor pressure in guard cells.
  - Pressure of the gases inside the leaves.
37. In guttation, plants can
- Excrete salts
  - Compensate organic substances
  - get rid of excess water.
38. Meaningful girdling experiment cannot be done on sugarcane because
- Phloem is present inside the xylem
  - It cannot tolerate the injury
  - Vascular bundles are scattered
  - Plant are very delicate.
39. The cell wall is permeable and not a semipermeable structure can be best deduced from the passage of water and mineral salts from
- Soil in to periplasmic space of root hairs.
  - Root hairs to cortical cells
  - Cortical cells to pericycle
  - Pericycle to tracheid
40. The pathway of water from soil up to secondary xylem is
- Soil → root hair cell wall → cortex → endodermis → pericycle → protoxylem → metaxylem
  - Metaxylem → protoxylem → cortex → soil → root hair
  - Pericycle → soil → root hair → cortex → endodermis → protoxylem → metaxylem
  - Cortex → root hair → endodermis → pericycle → protoxylem → metaxylem.

## SECTION B (60MARKS)

41. The diagram below shows some of the cells involved in the loss of water from part of the leaf. Use it to answer questions that follow.



(i) Name the tissues A and B on the diagram. (1mark)

A.....  
B.....

(ii) Describe the role of tissue B in the transportation of materials within the leaf. (2marks)

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(iii) State two structural adaptations of tissue A to its function. (2marks)

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(b) The table below shows the concentrations of potassium ions in some of the cells shown in the diagram when the stoma is open and when the stoma is closed.

Cell	Concentration of potassium ions/arbitrary units	
	Stoma open	Stoma open
Guard cell	95	448
Cell X	157	293
Cell Y	199	98
Cell Z	448	73

(i) Describe the changes that take place in the concentrations of potassium ions in cell X, Y and Z when the stoma opens. (2marks)

(ii) Explain how these changes in potassium ions concentration are related to the mechanism for the opening of the stoma. (3marks)

42. (a) (i) What is active transport?

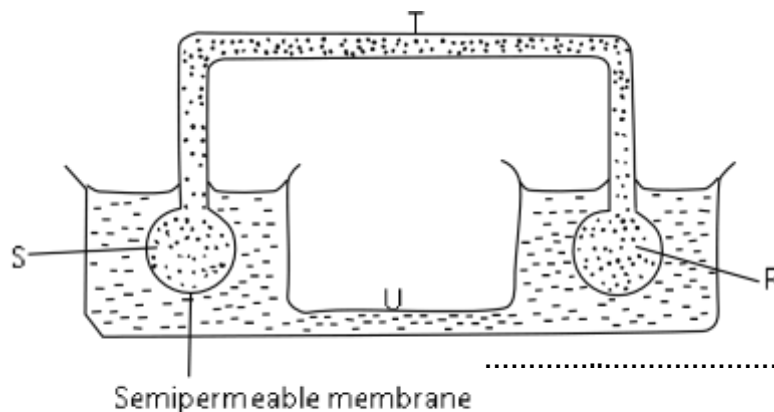
(1mark)

(ii) How is the occurrence of active transport in cell related with the structure of the plasma membrane? (2marks)

(iii) What evidence is there to account for the fact that active transport requires energy and it is selective? (2marks)

(b) Summarize the events that occur in the plant cells when it achieves full turgor. (2marks)

(c) Figure 6 represents the apparatus demonstrating the mass flow hypothesis.



(i) Referring to figure above, suggest which vessels are represented; T and U in plant. (1mark)

Vessel T

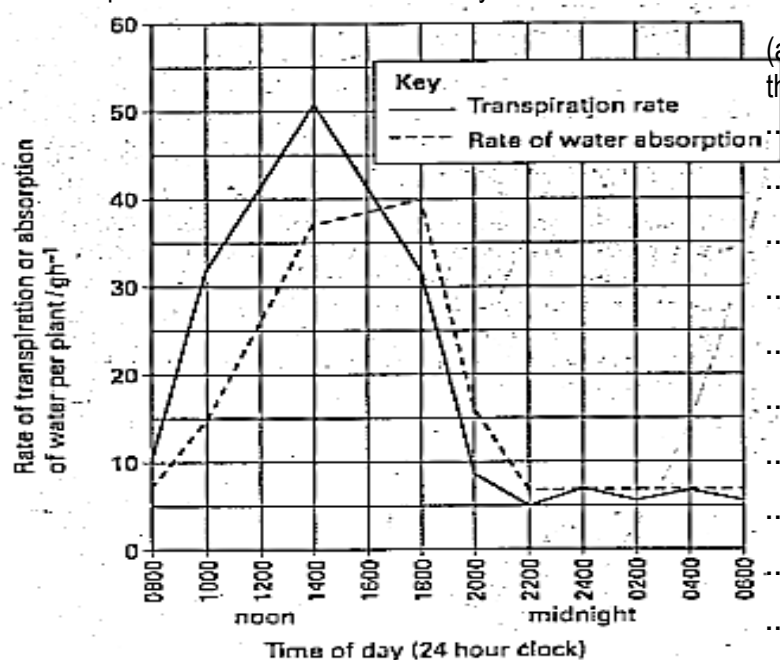
Vessel U

(ii) List two weakness of the above hypothesis (2marks)

S is a concentrated solution

R is dilute solution

43. An investigation was carried out in to relationship between the rate of water absorption and the rate of transpiration in sunflower plants at various times of the day. The results are shown in the diagram below.



(a) (i) Describe the changes in the rate of transpiration that took place during the experiment. (3marks)

(ii) Suggest why these changes occurred.

(3marks)

(b) Comment on the relationship between the rate of transpiration and the rate of water absorption during the experiment. (2marks)

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(c) Explain how relative humidity affects water absorption. (2marks).

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44. Explain the following biological phenomena in plant transport. (a) Why plants need a transport system. (3marks)

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(b) A plant dies under waterlogged conditions. (4marks)

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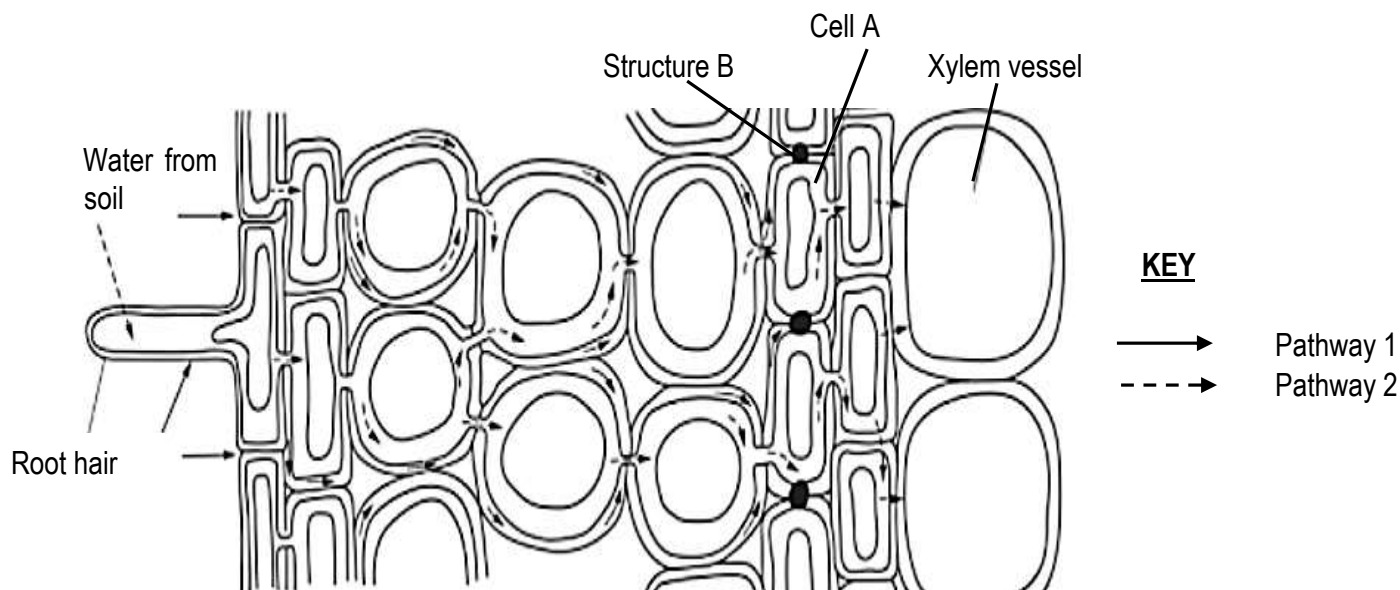
(c) Some plant roots form mutualistic associations like fungi. (3marks)

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45. Water absorbed by plant roots travels by different pathways from root hairs to the xylem. The figure below shows these pathways in root of a common buttercup – *Ranunculus acris* plant.



(a) (i) Identify the following parts of the diagram. (2marks)  
 Cell A..... Structure B.....

Pathway 1.....Pathway 2.....  
 (ii) Mention how water moves through pathway 2 to reach the xylem vessel. (2marks)

(b) Explain the significance of structure B in the transport of materials in to the xylem tissue. (3marks)

(c) Describe how water leaves cell A in to the xylem vessel. (2marks)

46. Two fruiting plants were treated with carbo dioxide containing radioactive carbon–14,  $^{14}\text{C}$  isotope. In one, a leaf from the upper part of them was fed with radioactive carbon dioxide whereas in the other, the treated leaf was on the lower part of the stem. The amounts of radioactivity found in various parts of the plants are shown below. Use the information to answer questions that follow.

Parts of plants	Radioactivity (counts min <sup>-1</sup> )	
	Plant A (leaf on upper part of stem treated)	Plant B (leaf on lower part of stem treated)
Shoot apex	1123	759
$^{14}\text{C}$ treated leaf	11325	11372
Untreated leaf	234	168
Stem	816	1160
Pod	9055	4937
Roots	842	2700

(a) (i) Name the two parts of plant A to which most carbohydrate was translocated. (1mark)

(ii) Suggest an explanation for the above answer. (2marks)

(b) Explain the main differences between the pattern of radioactive carbohydrate translocation in plants A and B. (5marks)

(c) Describe briefly an experimental method to test the hypothesis that phloem is the pathway for the translocation  $^{14}\text{C}$  carbohydrate. (2marks)

END