1.14 Plant Tissues, Transport and Transpiration: Test Pack

Total Marks

AQA 8464 · Calculator allowed · about 45 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Name the tissue in a plant that transports water from the roots to the leaves.

(Total for Question 1 is 1 mark)

2 State two features of root hair cells that help them absorb water and mineral ions.

(Total for Question 2 is 2 marks)

3 Suggest two reasons why cutting stomata on the lower leaf surface with a scalpel would lead to unreliable stomatal counts when using nail varnish impressions.

(Total for Question 3 is 2 marks)

4 A student draws a labelled diagram to show the movement of water across a root hair cell into the xylem. The diagram shows water moving through the cell membrane and then through the cytoplasm directly into the xylem vessels.

Explain why this diagram is incomplete. Give one additional pathway and one driving process.

(Total for Question 4 is 2 marks)

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5 Describe the functions of transpiration and of stomata in a leaf.

(Total for Question 5 is 3 marks)

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6 This question is about the structure of a leaf, which in cross section has palisade mesophyll, spongy mesophyll, stomata and vascular bundles (containing xylem and phloem).

(a) State which layer contains most chloroplasts and explain why. **(2)**

(b) Identify where xylem would be found and its role. **(2)**

(Total for Question 6 is 4 marks)

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7 In a potometer experiment, a student measures the distance an air bubble travels in a capillary tube as a proxy for water uptake. The student records the following distances in mm every 5 minutes: 0 min 0 mm, 5 min 18 mm, 10 min 35 mm, 15 min 51 mm. Calculate the average rate of water uptake in mm per minute between 5 and 15 minutes.

(Total for Question 7 is 3 marks)

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8 Describe one control variable that must be kept the same when comparing rates of transpiration between two potted plants, and explain why it must be controlled.

(Total for Question 8 is 3 marks)

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9 In the required practical to investigate transpiration, a student uses a potometer and records the following distances travelled by the air bubble in the capillary each hour for 4 hours: 0.0 cm, 1.8 cm, 3.7 cm, 5.5 cm, 7.1 cm. Plotting these on a graph of distance against time should produce a straight line through the origin if the rate is constant.

State one practical error that would cause the plotted points to lie below the expected straight line and explain why.

(Total for Question 9 is 4 marks)

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10 A student measures the concentration of mineral ions in the xylem sap using a conductivity probe. He finds that ion concentration increases towards the leaves.

Suggest two biological explanations for this observation.

(a) Suggest two biological explanations for ion concentration increasing towards the leaves. **(4)**

(Total for Question 10 is 4 marks)

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11 A student investigates how humidity affects transpiration. She places identical potted plants in two clear chambers. Chamber A is humidified so relative humidity is 80%, Chamber B is kept at 30% relative humidity. After 4 hours, the mass loss of the plant and pot (corrected for evaporation from a control pot) is 2.8 g in A and 9.6 g in B.

(a) Calculate the transpiration rate in g per hour for each chamber. **(2)**

(b) State the factor by which the rate in chamber B is larger than in chamber A. **(2)**

(Total for Question 11 is 4 marks)

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Mark scheme · 1.14 Plant Tissues, Transport and Transpiration: Test Pack

Question 1

xylem cao **B1**

Answer: Xylem

Question 2

large surface area (long projection, root hair) oe **B1**

thin cell wall / short diffusion distance or many mitochondria for active transport of ions, oe **B1**

Answer: Large surface area due to long root hair; thin cell wall or many mitochondria for active transport of ions.

Question 3

cutting damages cells, destroying stomata or altering appearance **B1**

cutting causes water loss or closure of stomata affecting count, or smear makes impressions unclear **B1**

Answer: Cutting damages or destroys stomata so they cannot be counted; cutting causes water loss or stomatal closure and smearing makes impressions unclear.

Question 4

mentions apoplast pathway (movement through cell walls) or vacuolar pathway as additional pathway **B1**

mentions osmosis (water potential gradient) as the driving process or active transport for ions creating gradient, oe **B1**

Answer: There is also an apoplast route (through cell walls) or vacuolar route; water moves by osmosis down a water potential gradient (created by ions entering xylem).

Question 5

transpiration results in loss of water vapour from leaves **B1**

transpiration helps to pull water up the xylem (transpiration stream) and transports minerals, oe **B1**

stomata open to allow gas exchange (CO_2 in for photosynthesis) and close to reduce water loss, oe **B1**

Answer: Transpiration is loss of water vapour from leaves and helps pull water up the xylem, transporting minerals. Stomata open for gas exchange (CO_2 in) and close to reduce water loss.

Question 6

(a) palisade mesophyll identified **B1**

(a) reason: cells are packed with chloroplasts and are near the top of the leaf to receive most light, oe **B1**

(a) Answer: Palisade mesophyll; its cells are packed with many chloroplasts and are near the upper surface to absorb most light.

(b) xylem located in vascular bundle (vein) **B1**

(b) role: transports water and mineral ions to the leaf, oe **B1**

(b) Answer: Xylem is in the vascular bundle (vein) and transports water and mineral ions to the leaf.

Question 7

computes change in distance and time: (51 - 18) mm over (15 - 5) min **M1**

substitutes and divides: 33 / 10 **M1**

3.3 mm per minute (to 2 s.f.) cao **A1**

Answer: 3.3 mm per minute

Question 8

identifies a control variable eg same pot size/soil type/plant species/leaf area/light intensity **B1**

explains how it affects transpiration eg leaf area affects surface for evaporation or light affects stomatal opening **B1**

links control to valid comparison eg to ensure differences are due to the tested variable, oe **B1**

Answer: Keep leaf area the same, because larger leaf area increases evaporation area and would change transpiration; this ensures differences are due to the tested variable.

Question 9

identifies an error eg air leak in joints, poor seal at cut stem, or bubble introduced by incorrect assembly **B1**

explains effect: leak reduces measured water uptake so distances are smaller **B1**

alternative error: not re-cutting stem under water so xylem blocked by air, with explanation **B1**

links to graph: points below expected straight line because measured uptake less than true uptake, oe **B1**

Answer: For example, an air leak at the joints means water enters the apparatus without moving the bubble in the capillary, so the recorded distances are smaller and points plot below the expected line.

Question 10

(a) active transport of ions into xylem in root and loading into xylem may cause concentration gradients as water is lost by transpiration **B1**

(a) water loss by transpiration concentrates ions in the xylem sap as it moves up **B1**

(a) ions may be unloaded into surrounding tissues at lower parts less than at upper parts leading to higher concentration near leaves **B1**

(a) transpiration stream may carry ions upward and evaporation at leaves reduces volume of water, increasing ion concentration **B1**

(a) Answer: Possible reasons: active transport loads ions into xylem and transpiration removes water so concentration increases; evaporation at leaves reduces water volume so ions become more concentrated as sap moves up.

Question 11

(a) computes rate for A: 2.8 g / 4 h and for B: 9.6 g / 4 h **M1**

(a) A = 0.70 g per hour, B = 2.4 g per hour cao **A1**

(a) Answer: A: 0.70 g per hour; B: 2.4 g per hour

(b) computes factor: 2.4 / 0.7 **M1**

(b) 3.43 (3.4 to 2 s.f.) or 3.4286... with ecf cao **A1**

(b) Answer: About 3.4 times larger

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