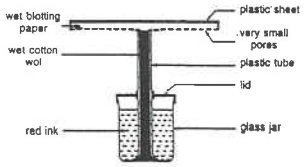
Past HKCEE Questions
Water and Organisms
Paper I

1. The diagram below shows a potted woody plant:

(i) If the plant was kept in darkness for 2 to 3 days, state and explain the direction of the flow of carbohydrate at point A.
(ii) Name the type of carbohydrate transported in the plant.
(iii) Name the tissue through which carbohydrate is transported.
(iv) If a ring of bark containing the tissue in (iii) is removed at B, and the plant is then exposed to sunlight for two months, describe and explain the resulting appearance of the stem above and below B.
(v) Name the tissue which conducts water from the roots to the leaves.
(vi) State and explain what would happen to the leaves if the plant was not watered for 10 days. (15 marks)
(HKCEE 1981)

2 The diagram below shows a model constructed to represent the structures of certain parts of a flowering plant. It is used to demonstrate certain processes.

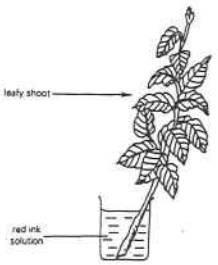


After the model was set up, the cotton wool in the plastic tube gradually became red. The model was placed in different locations and its loss in weight was recorded in the table below:

Experiment	Location of the model	Loss in weight ($g\ h^{-1}$)
I	on a bench	1.0
II	under an electric fan	1.8
III	inside a plastic bag	0.1

(i) Name the structures of the flowering plant represented by
(1) the plastic sheet,
(2) the pores in the plastic sheet, and
(3) the blotting paper.
(ii) What life processes are being demonstrated as revealed by
(1) the colour change of the cotton wool, and
(2) the weight loss of the model?
(3) Why is there a loss in weight in Experiment I?
(4) Explain the differing results from Experiments II and III. (10 marks)
(HKCEE 1982)

3. In order to determine the path and rate of ascent of water in the leafy shoot of a herbaceous plant, a student set up an experiment as shown in the diagram below:



Three hours later, cross-sections of the shoot were cut, starting from the top end, until red ink appeared in the cut section. The length of the remaining shoot in the beaker was measured 15cm.

(i) State and explain the precaution that should always be taken in preparing, the shoot for this experiment.
(ii) Name two causes which are responsible for the ascent of the solution in the shoot.

(iii) Name the tissue in the cut section that was stained red.
(iv) What was the approximate rate of ascent of the solution?
(v) State and explain how the results would differ if the experiment were performed in a brighter location.
(vi) The remaining leafy shoot, together with a strip of the epidermis taken from one of its leaves, were then transferred to a concentrated salt solution and left there overnight.
(1) How would the shoot appear on the following morning?
(2) Draw a labelled diagram to show how one of the epidermal cells would appear under a microscope.
(HKCEE 1983)

4. In an experiment to study osmosis in plant cells, seven similar strips cut from a fresh potato were put in sucrose solutions of different concentrations for three hours. The percentage change in mass in each strip was calculated according to the following formula:

$$\frac{\text{final mass} - \text{initial mass}}{\text{initial mass}} \times 100\%$$

The results obtained are shown in the table below:

Concentration of sucrose solution (%)	Percentage change in mass
0 (water)	+20.0
5	+6.0
10	−7.0
15	−20.0
20	−33.5
25	−40.6
30	−43.6

(i) Use graph paper to draw a curve to show the above results.
(ii) Give an appropriate title to your graph in (i).
(iii) From your graph, find the sucrose concentration at which there is no net water movement in or out of the potato cells.
(iv) If each potato strip used were cut into an equal number of smaller pieces before immersion, state and explain what advantage would be gained by doing this.

(v) Explain why boiled potato strips should not be used in the experiment. (9 marks)
(HKCEE 1984)

5. An experiment was conducted to study the relationship between the rate of transpiration and the number of stomata on a dorsi-ventral leaf from two plants, A and B. A student placed identical strips of dry cobalt chloride papers on both surfaces and recorded the time taken for the paper to change colour. The number of stomata on the epidermis of the leaves was then counted. The results obtained are shown in the table below:

Plant	A		B	
Leaf surface	upper	lower	upper	lower
Time(minutes) taken for cobalt chloride paper to change colour	7	1	more than 60	6
Number of stomata / mm^2	0	170	0	10

(i) Draw a labelled diagram to show the appearance of a stoma and its neighbouring cells on a leaf surface as seen under the high power magnification of a microscope.
(ii) Why should identical strips of cobalt chloride paper be used?
(iii) State the colour of the cobalt chloride paper
(1) when dry.
(2) when wet.
(iv) Give one possible reason why the rate of transpiration from the upper leaf surface of plant A is much greater than that of plant B.
(v) State the conclusion that could be drawn from the results shown by the lower leaf surfaces of plants A and B.
(vi) In what type of terrestrial habitat would you expect to find plant B?
(HKCEE 1985)

6. The following experiment was performed to investigate the effects of sucrose solution on the appearance of epidermal cells of a leaf. Eight similar strips of leaf epidermis were put separately into sucrose solutions of different concentrations. After 10 minutes, each strip was mounted on a microscope slide with a drop of the solution in which it had been immersed. When an area covering about 20 cells from each strip was examined under the microscope, the number of plasmolysed cells was counted. The results are shown in the table below:

Sucrose concentration ($mol\ dm^{-3}$)	Number of plasmolysed cells	Total number of cells examined
0.00	0	22
0.05	0	20
0.10	0	18
0.15	1	20
0.20	3	20
0.25	16	20
0.30	19	19
0.35	21	21

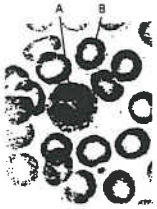
(i) Why should the epidermal strips be kept in the sucrose solutions for at least 10 minutes before being examined under the microscope? (1 mark)

(ii) Plot a graph of the percentage of plasmolysed cells against the concentration of sucrose solution. (4 marks)

(iii) From the graph in (ii), find the percentage of plasmolysed cells when the sucrose concentration is 0.22 mol dm 3. Explain fully why at this concentration some cells were plasmolysed while others were not. (5 marks)

(HKCEE 1988)

7. Photomicrograph 1 shows some cells of a human blood smear.
Photomicrograph 2 shows some cells of an onion epidermis.



Photomicrograph 1

Photomicrograph 2

(i) With reference to the photomicrographs only, state TWO structural differences between cell A and cell C. (2 marks)

(ii)
(1) The central part of cell B looks lighter in colour. Explain this with reference to its shape. (2 marks)
(2) How is this shape related to its function? (2 marks)

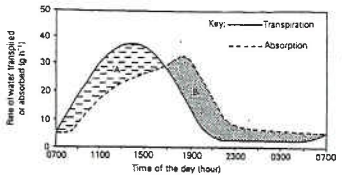
(iii) Cell A is found in large numbers in wounds. What is the function of cell A there? (1 mark)

(iv) Describe and explain what would happen if cell B were put into a concentrated sugar solution for 20 minutes.(2 marks)

(v) Make a labelled drawing of cell C if the onion epidermis were put into a hypertonic solution for 20 minutes. (3 marks)

(HKCEE 1991)

8. The graph below shows the rates of water absorption and transpiration of a plant during a 24-hour period:



(i) Describe and explain the changes in the rates of water absorption and transpiration of the plant in relation to the relative size of the stomatal pores at 1300 hours and 2100 hours. (4 marks)

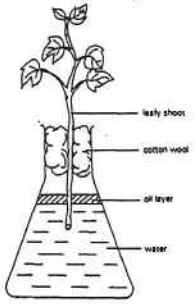
(ii) Explain why area B must be larger than that of A if the plant is to grow normally. (3 marks)

(iii) State one structural feature which enables the guard cells to regulate the size of a stoma. (1 mark)

(iv) Name a structure on the human skin having a function similar to that of the stomata in plants. State this function. (2 marks)

(HKCEE 1992)

9. The experimental set-up shown below is used to study the effect of different environmental factors on the rate of water loss of a leafy shoot:



(i) Briefly describe how you can make use of this set-up to measure the rate of water loss of the leafy shoot. (3 marks)

(ii) What is the purpose of adding a layer of oil on top of the water? (1 mark)

(iii) The set-up was put under different environmental conditions and the rates of water loss were measured. The results were as follows:

Environmental conditions	Rate of water loss ($g\ h^{-1}$)
(A) sunny and humid	14
(B) sunny and dry	32
(C) dark and dry	8

(1) Explain the difference in the rates of water loss under conditions A and B. (2 marks)

(2) With reference to the results shown in the table, what can you conclude about the effect of light on the rate of water loss? Explain how light produces such an effect. (3 marks)

(HKCEE 1993)

10.

(iii) Explain why more water vapour is lost through leaves during the daytime than at night. (3 marks)

(HKCEE 1994)

11. A 10 cm long potato strip was placed in a sugar solution. Its length was measured at regular intervals over a period of 3 hours. The results are shown is the table below

Time (hour)	Length of the potato strip (cm)
0	10.0
0.5	9.7
1.0	9.4
1.5	9.1
2.0	8.9
2.5	8.8
3.0	8.8

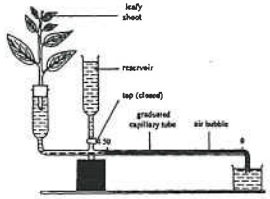
(i) Present the results in the form of a graph which should have a suitable title. (3 marks)

(ii) Explain the change in length of the potato strip in the first hour. (4 marks)

(iii)
(1) From your graph, find the period of time during which the length of the potato strip remained unchanged. (1 mark)
(2) Explain why there was no change in length during this period. (2 marks)

(HKCEE 1994)

12. The diagram below shows a set-up used to compare the rate of water loss from a leafy shoot at different light intensities:



At each light intensity, the initial and final positions of the air bubble were recorded as shown below:

Light intensity (arbitrary unit)	Initial position of bubble (mm)	Position of bubble after 10 minutes (mm)
10	0	15
20	2	22
30	1	26
40	3	33

(i) Explain why the air bubble moved during the experiment. (2 marks)

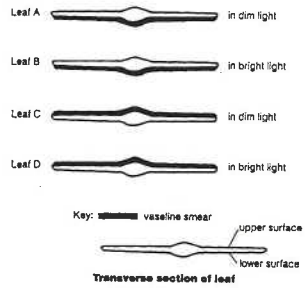
(ii) Calculate the tale of water loss at different light intensities in terms of the distance travelled by the bubble per minute. Present your results in a table. (3 marks)

(iii) Based on the experimental results, explain the effect of light intensity on the rate of water loss. (3 marks)

(iv) How would you adjust the position of the bubble before taking a stew set of readings? (1 mark)

(HKCEE 1996)

13. An experiment was carried out to study the rate of water loss from the leaves of a plant under different conditions. Four similar leaves A, B, C and D were detached. For each leaf, the area of one surface was estimated to be 100 cm^3. The four leaves were then smeared with vaseline and put under different light conditions as shown in the diagrams below: (To illustrate the treatments, only the transverse sections of the leaves are shown.)

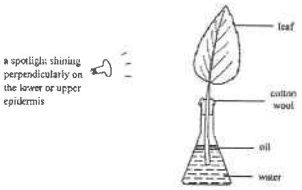


The initial mass of the leaves and their mass after 1 hour of light treatment were measured and the results are shown in the table below:

Leaf	Initial mass of leaf (g)	Mass of leaf after 1 hour (g)
A	9.2	9.0
B	9.4	8.8
C	9.5	9.4
D	9.1	8.9

(i) Name the biological process by which the leaves lose water. (1 mark)
(ii) Describe how the area of one surface of a leaf can be estimated. (2 marks)
(iii) Calculate the rate of water loss of each leaf in terms of the decrease in mass per unit area per hour. Present your results in a table. (2 marks)
(iv)
(1) Based on your calculations in (iii) above, state which leaf surface lost water at a faster rate in bright light. (1 mark)
(2) Suggest one structural feature of this leaf surface which would result in a faster rate of water loss. (1 mark)
(3) Explain the effect of light intensity on the rate of water loss of the leaf. (3 marks)
(HKCEE 1997)

14. The following experiment was carried out under daylight conditions using a leaf freshly removed from a land plant:



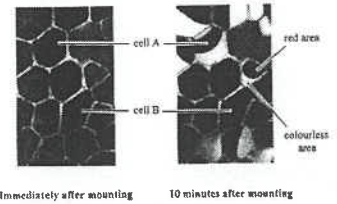
The initial mass of the set-up and its mass after 1 hour were measured. The results are shown in the table below:

Treatment	Surface illuminated by spotlight	Initial mass (g)	Mass after 1 hour (g)
I	lower epidermis	80.6	78.2
II	upper epidermis	78.0	77.4

(i) What is the change in mass of the set-up
(1) in treatment I,
(2) in treatment II? (2 marks)
(ii) What is the purpose of this experiment? (2 marks)
(iii) Given that stomata are only present on the lower epidermis of the leaf, suggest an explanation to account for the results of the experiment. (5 marks)
(iv) Briefly describe how you would demonstrate that stomata are only present on the lower epidermis. (2 marks)
(HKCEE 1999)

15. To study the effect of sucrose solution on plant cells, a student used the lower epidermis of a *Rhoeo discolor* leaf, the cells of which contain a red pigment. He mounted a piece of the lower epidermis in a sucrose solution. He then observed the epidermis under the microscope immediately and after 10 minutes.

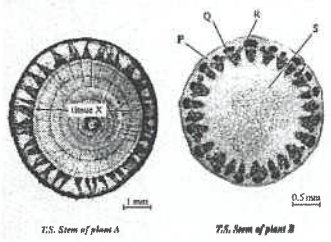
The photomicrographs below show the conditions of the same epidermal cells under the low power of the microscope:



Immediately after mounting 10 minutes after mounting

(i) Describe and explain the change in the appearance of cell A 10 minutes after mounting. (4 marks)
(ii) Suggest a reason why cell B did not show the same change as cell A. (1 mark)
(iii) The student wanted to examine cell A under the high power of the microscope.
(1) State one action that he might need to take before turning to the high power objective. (1 mark)
(2) State two actions that he might need to take after turning to the high power objective. (2 marks)
(HKCEE 2000)

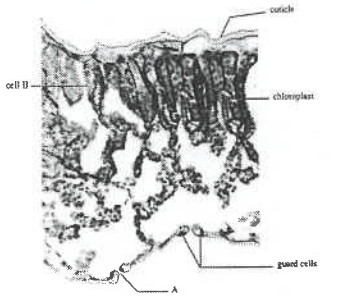
16. The photomicrographs below show the transverse sections of stems taken from two plants:



T.S. Stem of plant A T.S. Stem of plant B

(i)
(1) Name tissue X. (1 mark)
(2) Explain one way in which the cells in tissue X are structurally adapted to the function of transport. (2 marks)
(ii) Which region(s) (P, Q, R or S) in the stem of plant B contains tissue X? (1 mark)
(HKCEE 2001)

17. The photomicrographs below show part of the transverse section of the leaf blade of a terrestrial dicotyledonous plant and that of a moss:

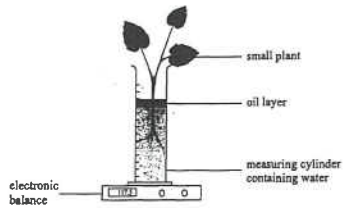


T.S. of the leaf blade of the dicotyledonous plant (magnification x100)

T.S. of the leaf blade of the moss (magnification x200)

(i)
(1) Name structure A. (1 mark)
(2) Explain one way in which A contributes to the function of cell B under bright sunlight. (2 marks)
(ii) The moss above is restricted to damp and shady environments and it is often covered with a thin film of water.
(1) With reference to the leaf structures shown in the two photomicrographs, suggest two reasons why the moss cannot grow well in dry environments. (4 marks)
(2) Describe how the moss leaf obtains oxygen from the atmosphere at night. (3 marks)
(HKCEE 2002)

18. The diagram below shows a set-up used to study the water balance of a small plant. The whole set-up was put in a well-ventilated and well- illuminated room for 8 hours.

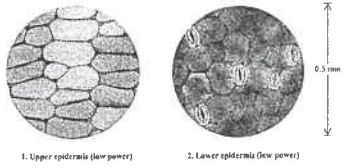


The initial and final readings in the measuring cylinder and the balance are tabulated below:

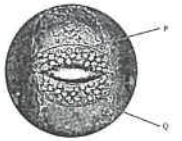
	Initial reading	Final reading	Change in reading
Water level in the measuring cylinder (cm^3)	45.0	43.5	*x*
Reading of the balance (g)	117.5	116.3	*y*

(i)
(1) Find values x and y. (1 mark)
(2) With reference to the water balance of the plant, what do x and y represent respectively? (2 marks)
(3) Compare values x and y. Explain the significance of their difference to the healthy growth of the plant. (3 marks)
(Given: 1 cm^3 of water weighs 1 g)
(ii) Predict, with reasons, the change in value x if the study is repeated with the leaves of the plant smeared with vaseline on both surfaces. (4 marks)
(HKCEE 2002)

19. Mary examined the epidermis of the leaf of a land plant under the microscope. The photomicrographs below show the appearance of the upper and lower epidermis under different magnifications



1. Upper epidermis (low power) 2. Lower epidermis (low power)



3. Lower epidermis (high power)

(i) Using the information provided in photomicrograph 2, calculate the stomata) density (i.e. number of stomata per unit area) of the lower epidermis. (Take It = 3.14) (2 marks)

(ii) Compare the stomatal density of the upper and lower epidermis of the leaf. Explain the significance of this pattern of stomata] distribution to the plain when it is under direct sunlight. (3 marks)

(iii) Name structures P and Q. (2 marks)

(iv) Under certain conditions, the stomata of the leaves may become closed during daytime Explain how this would affect the rate of photosynthesis of the plant. (2 marks)

20. In 1890, a German scientist named Eduard Strasburger conducted an experiment to study the transport of water in plants. He cut the stem of a woody plant and immersed the cut end in a poisonous solution. Upon contact, the poisonous solution killed all living cells in its way.

(i) Strasburger found that the plant continued to take up 30 litres of solution and transport the solution up to a height of 20 metres in two weeks. Based on his findings, what conclusion can you draw regarding the cells involved in water transport? (1 mark)

(ii) Based on present day knowledge of the mechanism of water transport in plants, explain why the treated plant can continue to transport the solution up the stem. (3 marks)

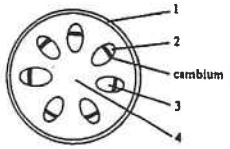
(iii) Describe how you would carry out an investigation with a small dicotyledonous plant that allows you to identify the cell type for water transport. (3 marks)

(iv) Explain why the cut stem of the woody plant can remain upright even after the cells had been killed by the poisonous solution. (2 marks)

(HKCEE 2006)

Past HKCEE Questions
Water and Organisms
Paper II

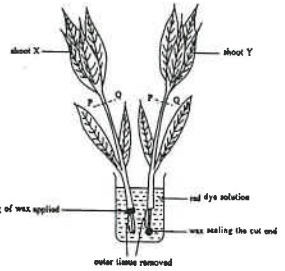
92.
Directions: Questions 3 and 4 refer to the diagram below which shows a transverse section of a young dicotyledonous stem:



92-3
Which region is made up of cells with the thickest cell wall?
A. 1
B. 2
C. 3
D. 4

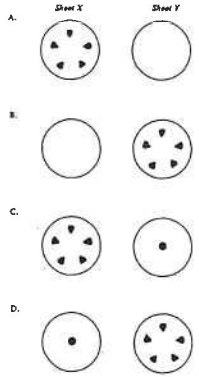
92-4
Which region is responsible for the transport of organic nutrients?
A. 1
B. 2
C. 3
D. 4

94.
Directions: Questions 21 and 22 refer to the diagram below which shows two woody shoots taken from the same plant. The shoots were ringed by removing a ring of the outer tissue at the lower part. Wax was applied to shoot X and shoot Y in the positions shown in the diagram. Both shoots were then placed in a rat dye solution.

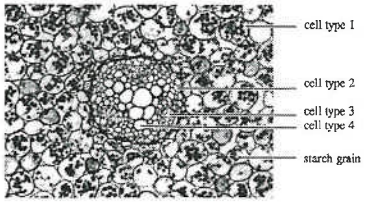


94-21
After one hour, the leaves of shoot X remained upright while those of shoot Y wilted. Which of the following may be deduced from this observation?
A. The xylem in the shoots had been removal.
B. The leaves of the shoots were mainly supported by turgid cells.
C. Food in the leaves of shoot Y was transported away through the phloem.
D. Water in the leaves of shoot Y moved to the dye solution by osmosis.

94-22
Sections were then cut across the shoots at region PQ and examined under a low-powered microscope. Which of the following shows the most probable location of the red colour?
(Key: ■ red colour)



99.
Directions: Questions 4 and 5 refer to the photomicrograph below, which shows part of a section of a young root:

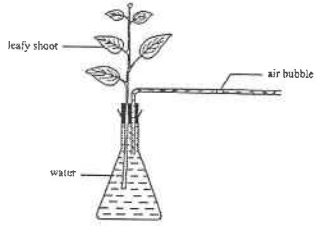


99-4
Which type of cells cannot break down food to release energy?
A. cell type 1
B. cell type 2
C. cell type 3
D. cell type 4

99-5
Which of the following correctly states the functions of cell types 1 and 4?

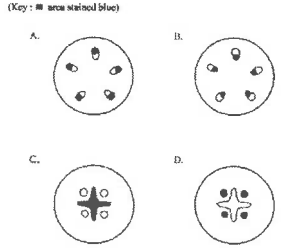
	Cell type 1	*Cell type 4*
A.	photosynthesis	food transport
B.	photosynthesis	water transport
C.	food storage	food transport
D.	food storage	water transport

99-21

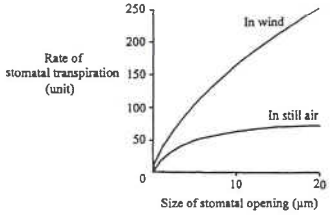


In the set-up above, the rate of movement of the air bubble measures
A. the rate of osmosis.
B. the rate of transpiration.
C. the rate of active transport.
D. the rate of water absorption.

99-29
Mary bought a bunch of blue flowers from the market. In order to find out whether the colour was artificially introduced or not, she prepared a section of the stem and observed it under the microscope. Which of the following correctly shows the condition of the section if the colour of the flowers was artificially introduced?

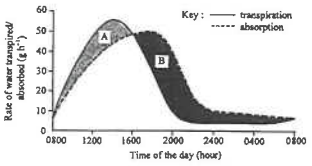


00-14
The graph below shows the relationship between the rate of stomatal transpiration and the size of stomatal opening of a plant:



Which of the following can be concluded from the graph?
A. The stomata open wider under windy conditions.
B. Air movement reduces the relative humidity of air.
C. The wider the stomata, the higher the rate of transpiration.
D. The rate of water absorption of the plant is lower in still air.

00
Directions: Questions 17 to 19 refer to the graph below, which shows the rates of transpiration and water absorption of a plant for a period of 24 hours:

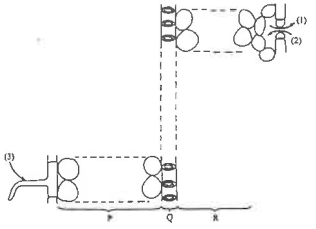


00-17
The change in transpiration rate of the plant from 0800 to 1400 hour was most likely caused by an increase in
A. the rate of water absorption of the plant.
B. the rate of photosynthesis of the plant.
C. air movement.
D. air temperature.

00-18
The rate of water loss from the plant was higher than its rate of water uptake at
A. 0800 hour.
B. 1200 hour.
C. 1600 hour.
D. 2000 hour.

00-19
Area B was found to be greater than area A. A probable reason for this is that
A. the relative humidity of air was high.
B. the plant could absorb moisture from the air.
C. new cells were formed by the plant during plant growth.
D. the respiration rate of the plant was higher than its photosynthetic rate.

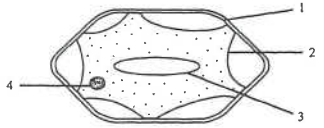
00.
Directions: Questions 30 and 31 refer to the diagram below, which is a diagrammatic representation of the root and the leaf of a plant:



00-30
The direction of oxygen diffusion between the plant and the surroundings under bright daylight is indicated by
A. (1) only.
B. (2) only.
C. (1) and (3) only.
D. (2) and (3) only.

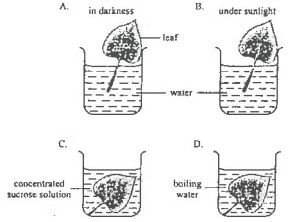
00-31
When the plant is deficient in water, which cell type(s) is/are important for supporting the plant?
A. Q only
B. P and Q only
C. P and R only
D. P, Q and R

01.
Directions: Questions 31 and 32 refer to the diagram below, which shows a cell in the lower epidermis of a leaf:

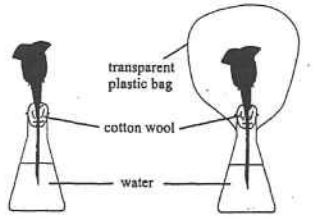


01-31
Which structure allows dissolved substances to pass through freely?
A. 1
B. 2
C. 3
D. 4

01-32
The lower epidermis was taken from a leaf that had been kept under one of the following conditions for 30 minutes. Under which condition was the leaf kept?



01.
Directions: Questions 52 to 54 refer to the diagram below, which shows two experimental set-ups. Two shoots with flower buds were used and after two days, the buds in both shoots developed into flowers.



The mass of each shoot and the whole set-up were recorded at the beginning of the experiment and after two days. The table below shows the measurements taken:

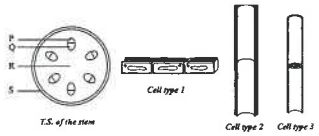
	Mass at the beginning (g)		Mass after 2 days (g)	
	Whole set-up	Shoot	Whole set-up	Shoot
Set-up 1	182.41	5.75	179.10	7.29
Set-up 2	183.86	5.78	183.63	7.38

01-52
The change in mass of the whole set-up 1 during the experiment was mainly caused by
A. respiration.
B. photosynthesis.
C. transpiration.
D. water absorption.

01-53
The change in mass of the shoots during the experiment was due to
A. growth.
B. respiration.
C. evaporation.
D. mineral absorption.

01-54
Based on the results of this experiment, which of the following is a probable conclusion?
A. Transpiration facilitates mineral absorption.
B. Water gained by the shoot is increased by transpiration.
C. The rate of photosynthesis is higher than the rate of respiration.
D. The growth of the buds into flowers is not affected by transpiration.

02.
Directions: Questions 43 to 45 refer to the diagrams below, which show the transverse section of the stem of a young herbaceous plant and three types of cells found in it



02-43
Which of the following correctly lists the location of the three types of cells in the stem?

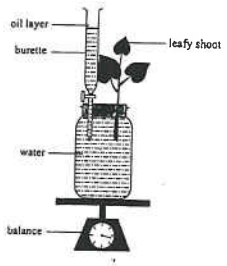
	Cell type 1	Cell type 2	Cell type 3
A.	R	P	Q
B.	S	P	Q
C.	R	Q	P
D.	S	Q	P

02-44
Which of the following comparisons between cell types 2 and 3 is Incorrect?

	Cell type 2	Cell type 3
A.	dead cells	living cells
B.	without end walls	with end walls
C.	for transporting inorganic minerals	for transporting organic substances
D.	direction of transport is downwards	direction of transport is upwards

02-45
On a hot dry day, the young plant wilted and its stem bent. This is due to the loss of water from
A. P.
B. Q.
C. R.
D. S.

03.
Directions: Questions 19 and 20 refer to the set-up below:



03-19
In order to find out the rate of water absorption of the leafy shoot, which of the following data are required?
(1) duration of the study
(2) total surface area of the leaves
(3) change in the reading of the balance
(4) change in the water level in the burette
A. (1) and (3)
B. (1) and (4)
C. (2) and (3)
D. (2) and (4)

03-20
The change in the reading of the balance would be largest if the set-up is placed in
A. a hot and bright condition.
B. a cold and humid condition.
C. a cool and dark condition
D. a warm and still-air condition.

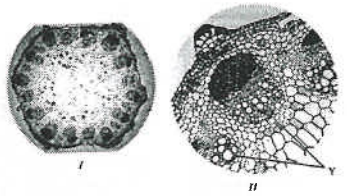
04-04
A student examined the distribution of stomata in the leaves of three different plants: a land plant with broad leaves, a water plant with -floating leaves and a water plant with submerged leaves. The results are shown below:

Plant	Stomatal density (number per mm²)	
	Upper epidermis	Lower epidermis
P	30	0
Q	0	0
R	12	35

Which of the following correctly identifies the three plants?

	Land plant	*Water plant with floating leaves*	*Water plant with submerged leaves*
A.	P	R	Q
B.	Q	P	R
C.	R	Q	P
D.	R	P	Q

Directions: Questions 13 and 14 refer to the photomicrographs below, which show the cross section of a stem under different magnifications:



04-13
A student first focused on the section under the microscope and saw the section as shown in I. In order to see the section as shown in II, the following steps are required. Arrange them in the correct sequence.
(1) Turn the nosepiece for an objective of higher magnification.
(2) Turn the coarse adjustment knob / fine adjustment knob.
(3) Adjust the position of the section on the stage.
A. (2), (1), (3)
B. (2),(3), (1)
C. (3), (1), (2)
D. (3), (2), (1)

04-14
What is the function of cell type Y?
A. to conduct sugar away from the leaves
B. to maintain turgidity of the stem
C. to transport mineral salts
D. to store starch

04-17
On a hot summer afternoon, the shoot of a herbaceous plant may become wilted for several hours and most stomata of its leaves are closed. What is the advantage of the stomatal closure to the wilted plant?
A. to reduce the transpiration rate
B. to reduce the rate of gaseous exchange
C. to cut down water absorption from the root
D. to avoid further increase in leaf temperature

04-18
Referring to question 17, the wilted plant usually restores its upright appearance in the late afternoon. This is because
A. the stomata become opened.
B. the photosynthetic rate drops.
C. the transpiration rate decreases.
D. the respiratory rate increases.

04-46
Which of the following correctly compares the transport of substances in the xylem and phloem?

	Transport in xylem	*Transport In phloem*
A.	occurs in dead cells	occurs in living cells
B.	transports sugars	transports amino acids
C.	occurs both day and night	occurs only at night
D.	transports substances in two directions	transports substances in one direction only

05-9
Which of the following correctly matches the cell types with their features?

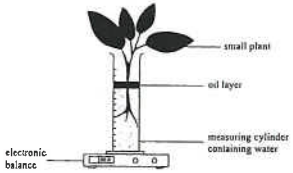
	Cell type	Feature
(1)	xylem vessel	tube-like cell with no nucleus
(2)	mesophyll cell	thin-walled cell with chloroplasts
(3)	root epidermal cell	thin-walled cell with cuticle

A. (1) only
B. (3) only
C. (1) and (2) only
D. (2) and (3) only

05-42
Carbohydrate produced in leaves during photosynthesis can be carried to the roots for storage. What is the form of carbohydrate transported and the path involved?

	Form of carbohydrate	*Path of transport*
A.	sugar	xylem
B.	sugar	phloem
C.	starch	xylem
D.	starch	phloem

Directions: Questions 47 and 48 refer to the set-up below, which is used to study the water balance of a small plant:

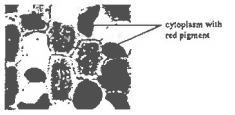


After 5 hours, the following results are recorded: Change in reading of the electronic balance = p gram Change in water level in the measuring cylinder = q cm^3 where p and q represent the magnitude of the change (Given: mass of 1 cm^3 of water = 1 gram)

05-47
Which of the following represents the amount of water retained by the plant in 5 hours?
A. *p*
B. *q*
C. *p-q*
D. *q-p*

05-48
The value p will be the highest when the set-up is put under
A. a bright and windy condition.
B. a bright and humid condition.
C. a dark and humid condition.
D. a dark and windy condition.

06-28
The photomicrograph below shows the appearance of the epidermal cells of a plant after they have been immersed in a sugar solution for an hour. The cytoplasm of the epidermal cells contains a red pigment. The colour intensity and distribution of pigment of different cells vary due to different rates of water loss.



Source: Acadia University, *Biodiversity of Plants and Algae Lab Images*, URL: [illegible]

The rate of water loss varies because
A. the cells have just started to lose water and have not yet reached equilibrium.
B. individual cells are located at different distances from the sugar solution.
C. the cells have different water potentials.
D. the cells have vacuole of different sizes.

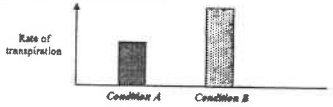
07-01
Which of the following correctly compares a leaf epidermal cell and a root hair cell of a flowering plant?

	Leaf epidermal cell	Root hair cell
A.	with cuticle	without cuticle
B.	with chloroplast	without chloroplast
C.	without vacuole	with vacuole
D.	without mitochondria	with mitochondria

07-02
Which of the following features enables a plant to survive successfully in a shady environment?

A. stem with more lenticels
B. stein with less supporting tissue
C. leaf with very broad and flat leaf blade
D. leaf with similar stomatal density on both surface

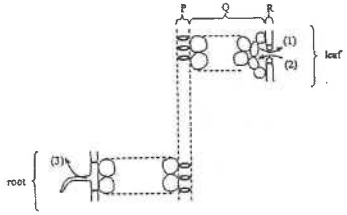
07-44
The graph below shows the transpiration rates of the same plant put under two different environmental conditions.



Which of the following is an unlikely combination of the conditions being studied?

	Condition A	Condition B
A.	still air	moving air
B.	air temperature 15°C	air temperature 25°C
C.	relative humidity 98%	relative humidity 75%
D.	0.03% carbon dioxide in air	0.01% carbon dioxide in air

07
Directions: Questions 46 and 47 refer to the diagram below, which shows a diagrammatic representation of the root and the leaf of a herbaceous plant:



07-46
The direction of carbon dioxide diffusion between the plant and the surroundings under bright daylight is indicated by

A. (1) only.
B. (2) only.
C. (1) and (3) only.
D. (2) and (3) only.

07-47
Which cell type(s) is / are important for supporting the plant?
A. P only
B. P and Q only
C. Q and R only
D. P, Q and R

Past HKCEE Questions
Water and Organisms
Suggested Answers

Paper I

1. (i) upwards 1
food must be supplied for the development of the bud 1
especially when there is no photosynthesis in darkness 1
(ii) Sucrose / sugars 1
(iii) phloem 1
(iv) above B - swollen 1
food above B cannot be transported downwards 1
so food accumulates there to form the swelling 1
stem below B - using up its reserved food without replenishment 1
(v) xylem 1
(vi) refer to the table below 4

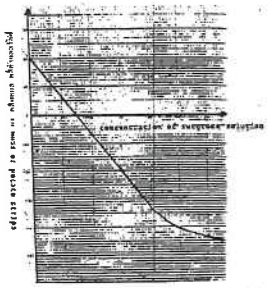
Observation (1 mark each)	Reasons (1 mark each)			observation max. 2
	(1)	(2)	(3)	
wilt	water transpired from leaves > water absorbed	causing plasmolysis of cells	tissue becomes flaccid	reason max. 2
turn yellow		no photosynthesis	reduced chlorophyll formation	
shed off	by root	to cut down water loss		

2. (i) (1) upper and/or lower epidermis
(2) stomata / stoma
(3) palisade and 1
spongy cells 1
(OR mesophyll, 2 marks)
(ii) (1) Transpiration pull / water translocation 1
(2) Transpiration 1
(iii) Evaporation 1
(iv)

Experiment	II	III	
Difference	faster / greater	slower / less	1 (either)
Explanation	wind blows away water vapour	air inside bag is saturated with water vapour	1 + 1

3. (i) cut lower end of shoot under red ink solution 1
to avoid entry of air bubbles / air blocking 1
(ii) capillarity 1
transpiration pull 1
(iii) * xylem 1
(iv) 15/3 or 5 1
cm/hr 1
(v) higher rate of ascent 1
owing to increase in stomatal aperture / increase in transpiration 1
(vi) (1) leaves showing wilting / drooping 1
(2) drawing: plasmolysed cell 1
labels:
cell wall + protoplasm 0.5
cytoplasm 0.5

4. (i) correct axis/ axes 1
at least FIVE points correctly plotted 1
joining up the points to form a smooth curve 1



(ii) N.B. Title given must correspond to the graph drawn
The relationship between (OR the variation of) percentage change in mass of potato strips and concentration of sucrose solutions
OR The percentage change in mass of potato strips against (OR versus) sucrose concentration 1

(e.g.)

(i) axis	(ii) title	marks
correct	correct (y against x)	1, 1
correct	wrong (e.g. x against y)	1, 0
wrong	corresponds to axes in graph	0, 1
wrong	does not correspond to axes in graph	0, 0

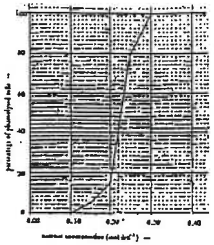
(iii) 7.5% (accept answers within the range of 7-8%) 1
(iv) shorten the time to achieve results 1
because surface area increased for water movement 1
(v) boiling destroyed cell membrane / membrane permeability 1
no osmosis 1

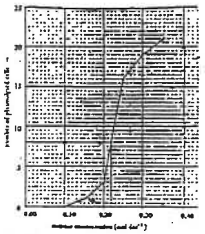
5. (i) Labels: (any 6) (0.5 x 6 = 3 max.) 3
epidermal cell, stomatal aperture / stoma, guard cells, nucleus, chloroplast, vacuole, cytoplasm, cell membrane, thick / inner wall, thin / outer wall (cell wall)
Diagram accuracy: 0.5
kidney-shaped 0.5
thick and thin regions of the cell wall
(ii) to make the covered areas a equal for al for comparison 1
(iii) (1) blue 1
(2) red / pink 1
(iv) A has thinner cuticle 1
(v) the rate of transpiration is proportional to the number of stomata 1
(vi) dry / arid / desert 1

6. (i)
- to ensure enough time is provided such that no net movement of water between the cells and the surrounding solution will take place
- the cells reach osmotic equilibrium with the surrounding solution

any 1 1

(ii) correct choice of axis with labels 1
correct percentage of plasmolysed cell (accept number of plasmolysed cells) 1
correct plotting of all points 1
joining up all the points (provided that the general shape of the graph is correct) 1





(iii) 40 ± 2 % 1
the cell sap of some cells had a higher water potential / water concentration than the surrounding sucrose solution 1
therefore water passed out of the cells by osmosis and the cells became plasmolysed 1
the cell sap of other cells had a lower water potential / water concentrations than the surrounding solution
therefore water passed into the cells by osmosis, and the cells 1
were not plasmolysed 1
[The cells were at different water potentials: 1 mark only]

7. .(i)

Cell A	Cell C	
round shape	angular shape	any 1, 1 2 pairs
no cell wall	has cell wall	
nucleus: large / irregular-shaped / lobed / centrally placed	nucleus: small / round / peripherally placed	
no vacuole	has vacuole	

(N.B. No comparison, no mark)

(ii) (1) The cell is a bi-concave disc 1
The central part contains less cytoplasm 1

(2) this provides a large surface area to volume ratio / shorter diffusion path 1
to facilitate diffusion of gases 1

(iii) to kill / engulf germs 1
(iv) The cell will shrink / become crenated 1
because water tends to move out by osmosis. 1
(v) Drawing:
showing the plasmolysed condition 1
quality of drawing e.g. resemblance to the cell shown, double-lined cell wall 1
labels: *cell wall, *cell membrane, *cytoplasm, *nucleus, *vacuole
(any 2 labels) (0.5 x 2) 1

8. (i) At 1300 hour the transpiration rate is high because the stomatal pores are widely open 1
The resulting high transpiration pull increases the rate of water absorption 1
At 2100 hour, the transpiration rate is low because the stomatal pores are small / closed 1
This leads to a decrease in the rate of water absorption 1
OR
The stomata are more widely open at 1300 hour than that at 2100 hour 1
Transpiration therefore occurs at a faster rate 1
The resulting larger transpiration pull 1
leads to a higher absorption rate 1
(ii) Areas A and B represent either the net amount of water lost or gained during the specified period of time 1
Area B larger than Area A means that there is a net gain of water over the 24-hour period 1
The net gain of water is essential for various life processed e.g. formation of new cells, photosynthesis, etc. 1
(iii) thicker inner cell wall and thinner outer wall / kidney-shaped 1
(iv) sweat pores / glands / blood capillaries prevent overheating 1

9. (i) Weigh the whole set-up at the beginning of the experiment 1
Over a period of time, weigh the set-up again to find the difference in weight 1
The loss in weight divided by the time elapsed equals to the rate of water loss by the leafy shot 1
(ii) To prevent water evaporating from the water surface 1

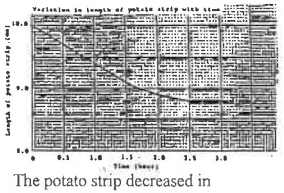
(iii) (1) In a humid condition, the diffusion gradient of water vapour between the air spaces in the leaf and the atmosphere is smaller than that in a dry condition. 1
Water vapour diffuses slowly to the atmosphere. 1
(2) Comparing (B) and (C), the rate of water loss in light (sunny) condition is higher than that in dark condition. 1
2

Any one set below: (1+1)
- It is because the stomata open in the presence of light
- facilitating the diffusion of water vapour through the stomatal pores

Or
- Leaf temperature is increased in the presence of light
- so the water evaporates faster

10. (iii) During daytime, stomata open in the presence of light 1
Temperature of air is higher / the relative humidity of air is lower / the rate of evaporation is faster 1
Water vapour diffuses faster / diffuses along a steeper concentration gradient through the stomatal pore 1

11. (i) title 1
correct choice of axes 1
correct labelling of axes with units 1
correct plotting and joining of all points 1



(ii) The potato strip decreased in length 1
This indicates that the potato cells were at a higher water potential than the sugar solution 1
Water moved out of the potato cells 1
The potato cells shrank in size / cells became less turgid. 1

(iii) (1) hour 2.5 to 3 1
(If the starting time lies between hour 2-2.5, must refer to the graph plotted)
(2) It is because the water potential of potato cells became equal to that of the sugar solution 1
There was no net water movement in and out of the cells (accept: no osmosis or no diffusion) 1

12. (i) As the plant lost water by transpiration / evaporation, 1
it absorbed water from the set-up, 1
so the air bubble moved towards the left.

(ii)

Light intensity (arbitrary unit)	Rate of water loss (mm min^{-1})
10	1.5
20	2.0
30	2.5
40	3.0

Rate of water loss at different light intensities

Results presented in a table with proper headings and units 1
Correct results (4 x 0.5) 2

(iii) The rate of water loss increased with an increase in light intensity 1

Reason: (any one set)
- The temperature increased at 1
- higher light intensity so the rate of diffusion of water / evaporation became faster 1

Or
- The stomatal pore increased in size at higher light intensity set 1
- so the rate of diffusion of water vapour became faster 1

Effective communication (c)

(iv) Open the tap of the reservoir until the bubble moved to the desired position 1

13. (i) *Transpiration 1
(ii) Trace the outline of the leaf on a graph paper 1
then count the number of (1 cm^2) squares within the outline 1
(No mark if the method is not workable)
(Deduct 0.5 mark if multiply the area by 2)

Leaf	Rate of water loss (g cm^{-2}h^{-1})
A	0.002
B	0.006
C	0.001
D	0.002

Correct results (1 or 0) 1
Results presented in table form with proper headings and units (0.5, 0.5) 1

(iv) (1) the upper surface
(2) • There are more stomata on the upper surface of the leaves
• The cuticle on the upper surface is thinner
Any one 1

(3) The rate of water loss increased at higher light intensity
Reason: (any one set below)
- The stomatal pore opened wider at higher light intensity 1
- so the rate of diffusion of water vapour became faster 1

OR
- The temperature set increased at higher light intensity
- so the rate of diffusion of water / evaporation became faster 1

1

14. (i) (1) mass decreases by 2.4 g 1
(2) mass decreases by 0.6 g 1
(Deduct 1 mark once if no unit is given)
(ii) any one set below: (1+1) 2
- To study the effect of direct illumination on the lower or upper epidermis
- on the rate of transpiration of the leaf

OR
- To compare the rate of transpiration of the leaf
- when the lower epidermis is illuminated by the spotlight with that when the upper epidermis is illuminated

(iii) Any one set below (5) 5

- The decrease in mass in treatment I is greater than that in treatment II,
- thus indicating that the transpiration rate in treatment I is higher
- Due to direct illumination by the spotlight, the temperature of the lower epidermis in treatment I is higher than that in treatment II
- This leads to faster evaporation of water
- Water vapour diffuses out more rapidly through the stomata Thus the transpiration rate is higher in treatment I.

OR

- Due to direct illumination by the spotlight,
- stomata of the lower epidermis open more widely in treatment I than in treatment II
- The surface area for the diffusion of water vapour is greater
- so that diffusion of water vapour becomes faster
- Thus the transpiration rate is higher in treatment I.

(iv) any one set below: (1+1) 2

- Peel off the upper and lower epidermis
- and observe under the microscope whether stomata are only present on lower epidermis

OR

- Immerse the leaf in hot water
- and observe whether bubbles are released from the lower epidermis only

15. (i) The water potential of the cell sap of cell A is greater than that of the sucrose solution 1
Water moves out of the cell by osmosis 1
The vacuole shrinks in size 1

pulling the cytoplasm / cell membrane away from the cell wall 1

Effective communication (C) 1

(ii) The water potential of the cell sap of cell B may be the same / lower than that of the surrounding solution (accept other reasonable answers) 1

(iii) (1) Adjust the position of the slide until cell A is at the centre of the field of vision 1

(2) Adjust the diaphragm/condenser to increase the illumination of the slide 1
Turn the a adjustment knob until the cell is in focus 1

16. (i) (1) *xylem 1
Any one set (1 + 1) 2

Structural feature	Adaptation
The xylem vessels in X have no cell content / no end walls / large lumen	This allows a free flow of water inside
The xylem vessels in X have thick cell wall	This can prevent the collapse of the xylem vessels

(ii) Region R 1

17. (i) (1) Stoma 1

(2) It allows carbon dioxide to enter the leaf 1
for photosynthesis in cell B 1

(ii) (1) The moss leaf has no cuticle / no waterproof covering 1
And it is one-cell thick 1
so the surface area to volume ratio is large 1
This would lead to a high rate of water loss from the plant / so the moss would become dehydrated easily in dry environment 1

(2) Any one set below (1,1,1) 3

- Atmospheric oxygen dissolves into the water film on the moss leaf
- and then diffuses in
- through the entire surface of the leaf

OR

- At night, moss cells carry out respiration only and thus lower the oxygen concentration in the cells
- Atmospheric oxygen dissolves into the water film on the moss leaf
- diffuses into the leaf

18. (i) (1) x= 1.5 0.5
y= 1.2 0.5

(2) x represents the amount of water absorbed by the plant 1
y represents the amount of water transpired/lost by the plant 1

(3) Value x is larger than value y 1
This indicates that there is a net gain of water by the plant 1
The water gained is essential for various life processes 1
e.g. formation of new cells, photosynthesis, support, cellular metabolism, etc
Effective communication (C) 1

(ii) Value x would decrease 1
because vaseline blocks the stomata and the leaf surfaces 1
so the rate of transpiration would drop 1
As transpiration enhances the absorption of water 1
less water would be absorbed by the plant

19. (i) Stomatal density of lower epidermis = $5 / [3.14 \times (0.25)^2]$ 1
$= 25.48 mm^{-2}$ 1

(ii) The upper epidermis has a lower stomatal density than the lower epidermis / the upper epidermis has no stomata while the lower epidermis has stomata 1
This helps to reduce water loss / the rate of transpiration of the leaf 1
because the temperature at the upper epidermis is higher when the plant is under direct sunlight 1
effective communication 1

(iii) P: *chloroplast 1
Q: * cell wall 1

(iv) The closure of the stomata limits the diffusion / intake of carbon dioxide into the leaf 1
Thus the rate of photosynthesis of the plant is reduced 1

20. (i) Living cells are not required in the transport of water up the stem 1

(ii) Water is transported up the stem mainly by transpiration pull 1
which is resulted from a physical process and thus can occur outside living cells 1
The transport of water occurs in dead xylem vessels 1
which remains functional even in the treated plants 1

(iii) Immerse the cut end of the small plant in a dye solution 1
After a few hours, cut a thin section of the upper part of the stem 1
Identify the cell type stained by the dye under the microscope 1

(iv) The woody stem is mainly supported by mechanical strength / rigidity / hardness 1
of the thick-walled cells / xylem vessels 1

Paper II

92-3	C
92-4	B
94-21	B
94-22	A
99-4	D
99-5	D
99-21	D
99-29	B
00-14	C
00-17	D
00-18	B
00-19	C
00-30	A
00-31	A
01-31	A
01-32	C
01-52	C
01-53	A
01-54	D
02-43	D
02-44	D
02-45	C
03-19	B
03-20	A
04-04	D
04-13	C
04-14	C
04-17	A
04-18	C
04-46	A
05-9	C
05-42	B
05-47	D
05-48	A
06-28	C
07-01	A

07-02	C
07-44	D
07-46	D
07-47	B