Unit 2: Body Systems, Genetics, Microorganisms and Health

B2.1 Osmosis and Plant Transport

Homework Booklet Name	
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Content - CCEA Double Award Biology 2 - Fort Hill Integrated College	Got it	Nearly	Haven't
B2.1 Osmosis and Plant Transport			
Osmosis, Plasmolysis and Turgidity			
Investigate the process of osmosis by measuring the change in length or mass of plant tissue or model cells, using Visking tubing (Prescribed Practical B5);			
Can you identify changes in plant cell structure that occur in plasmolysed and turgid cells due to osmosis?			
Can you explain osmosis as diffusion of water molecules from a dilute solution to a more concentrated solution, through a selectively permeable membrane?			
Can you explain how osmosis causes plant cells to become plasmolysed and turgid and demonstrate knowledge and understanding of the role of the cell wall in limiting the entry of water?			
The potometer	+		
Use a potometer (bubble and weight potometer) to investigate the factors affecting the rate of water uptake by a plant and washing line method to investigate the factors affecting the rate of water loss from leaves (Prescribed Practical B6).			
Transpiration			
Can you define transpiration as evaporation from mesophyll cells followed by diffusion through airspaces and stomata?			
Can you explain how surface area, wind, temperature, humidity and light intensity affect transpiration and the rate of water uptake by a plant?			
Uses of water			
Can you recall that plants use water for support, transport, transpiration and photosynthesis?	7		

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2	(a)	Со	mplete the definition for	transpiration by writing in the spaces below.	
		Tra	nspiration is the	of water from leaf	cells
		foll	owed by diffusion throug	gh the (pore	s). [2]
	(b)	(i)	Several factors affect	the rate of transpiration from leaves.	
			Complete the table to transpiration.	state how a change in each factor affects the r	ate of
			Choose your answer f	rom the list for each factor.	
			increasesdecreasesstays the same		
			Factor	How it affects the rate of transpiration	
			Higher wind speed		
			Higher temperature		
			Larger surface area		
			Higher humidity		[4]
		(ii)	Name the apparatus u leaves of a plant.	ised to measure the rate of transpiration from t	he [1]
	(c)	Giv	e one use of water in p	lants, other than in transpiration.	[4]
					[1]
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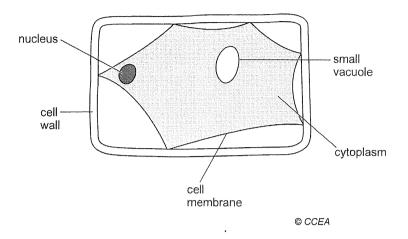


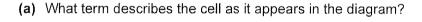
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Examiner Only

5 The diagram below shows a plant cell as seen under a microscope. The cell had been left in strong sugar solution for 30 minutes.





[1]

(b) Redraw the cell, to the same scale, as it would appear after being left in water for 30 minutes.

Label the cell wall, cell membrane and vacuole on your drawing.

[4]



Marks Remark

5 A group of pupils carried out an investigation into osmosis in carrot tissue.

The pupils cut carrot cylinders of similar size and weighed them.

They placed each cylinder into a different percentage concentration of sugar solution.

They left the cylinders for 24 hours, removed them, dried their surfaces and recorded the final masses in the table below.

Percentage concentration of sugar solution	Initial mass of carrot cylinder/g	Final mass of carrot cylinder/g	Change in mass/g	Percentage change in mass
0 (water)	6.5	7.3	+0.8	12.3
2	6.2	6.7	+0.5	8.1
4	6.6	6.8	+0.2	3.0
6	6.6	6.5	-0.1	-1.5
8	6.7	6.3	-0.4	-6.0
10	6.7	6.0		

(a) (i) Complete the table by calculating the change in mass and the percentage change in mass for the cylinder in 10% concentration of sugar solution.

Show your working.

[3]

(ii) Suggest why the pupils calculated the **percentage** change in mass rather than just the change in mass in grams.

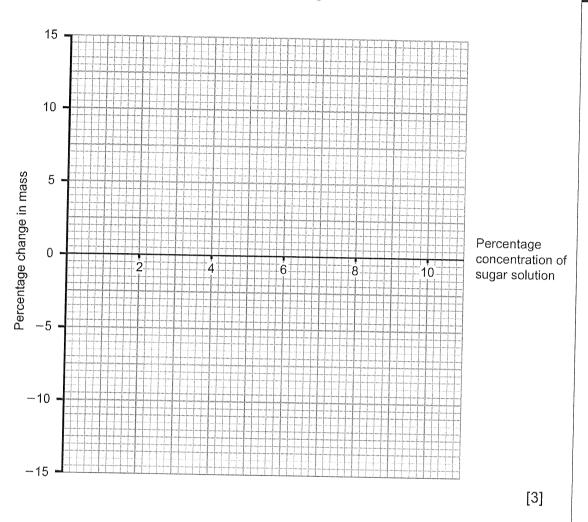
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(b) (i) Plot a line graph of percentage change in mass against the percentage concentration of sugar solution.



(ii) Use your graph to determine the percentage concentration of sugar solution in the cells of the carrot cylinders. Explain your answer.

Concentration	%	, D
on on a dion	70)

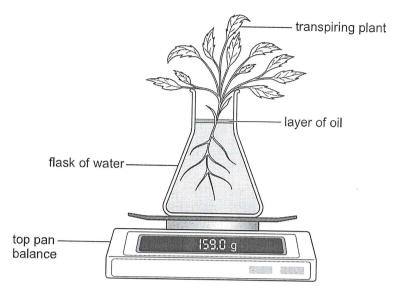
Explanation _____



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Marks Remark

The diagram shows apparatus which may be used to measure the rate of water uptake in plants.



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(a)	vvnatis	tne	tunction	of	the	layer	of	oil?	

__[1]

(b) Describe how you would use this apparatus to investigate the effect of the surface area of leaves on the rate of water uptake.

Name at least one variable that you should control during your investigation.

In this question	you will be asse	ssed on your writter	n
communication	skills, including	the use of specialis	t scientific
terms.		,	

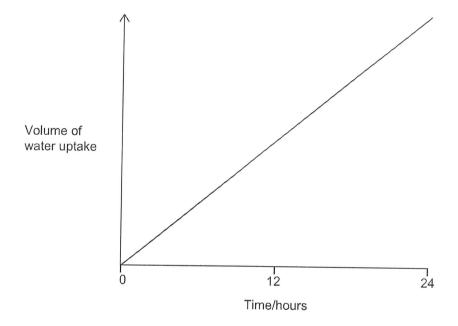


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(c) How would you expect the rate of water uptake to change in this investigation? Explain your answer.

Change in water uptake _____ [1]
Explanation ____ [1]

Another type of apparatus used to measure the rate of water uptake in a plant shoot is a bubble potometer. The graph shows the volume of water uptake in a plant shoot placed in a bubble potometer at 20 °C over a 24 hour period.



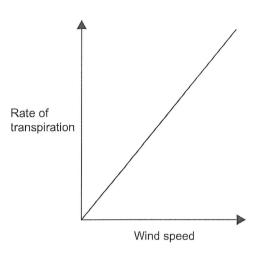
- (d) On the graph, draw the line that you would expect if the investigation was repeated at 30 °C. [2]
- (e) Give two uses of water in plants.

1. _____



Examiner Only Marks Remark

9 (a) The graph below shows the effect of increasing wind speed on the rate of transpiration in plants.

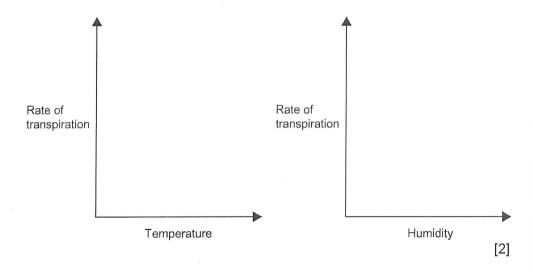


(i) Using the graph, describe the trend shown.

	[1]

Temperature and humidity are two other factors that have an effect on the rate of transpiration in plants.

(ii) On the axes below, draw a line to show the effect of increasing temperature and a line to show the effect of increasing humidity on the rate of transpiration.

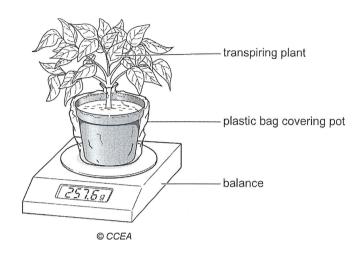


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(b) The diagram below shows apparatus used to investigate the effect of surface area of leaves on the rate of transpiration in a plant.





(i)	Suggest	why	the	pot	was	covered	with	а	plastic	bag.
-----	---------	-----	-----	-----	-----	---------	------	---	---------	------

______[1]

The plant was weighed, left for 24 hours and then reweighed.

The rate of transpiration was calculated as 3.8g per hour.

Some leaves were removed from the plant and the experiment was repeated.

The table below shows the result for the second experiment.

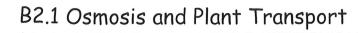
Mass of plant at start /g	Mass of plant after 24 hours /g
257.6	185.6

(ii) Using the data in the table above, calculate the rate of transpiration (in g per hour) in the second experiment.

Show your working.

_____ g per hour [2]

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Marks Remark

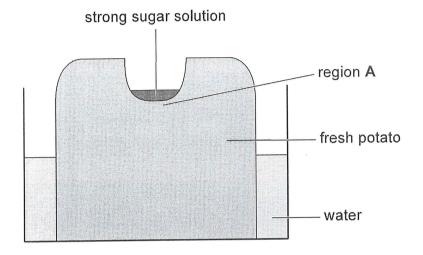
(iii)	Explain why the rate of transpiration is lower when some leaves were removed.	3
		[2]
(iv)	Plants use water in transpiration.	
	Give two other uses of water by a plant.	
	1	
	2	[2]

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12 Megan and Paul set up an experiment to investigate osmosis in a potato.

The diagram shows the levels of strong sugar solution and water at the start of the experiment.



The experiment was left for 4 hours.

(a)	Describe what happened to the level of the strong solution after 4 hours.
	Explain your answer.

(b) Describe how the vacuole and the cell membrane from a cell in region A will have changed after 4 hours, when the cell has become plasmolysed.

Vacuole _____

Cell membrane ______

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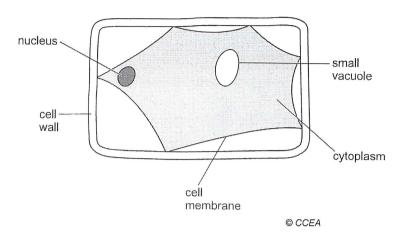
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Examiner Only

Marks Remark

1 The diagram below shows a plant cell as seen under a microscope. The cell had been left in strong sugar solution for 30 minutes.



(a) What term describes the cell as it appears in the diagram?

[1]

(b) Redraw the cell, to the same scale, as it would appear after being left in water for 30 minutes.

Label the cell wall, cell membrane and vacuole on your drawing.

[4]

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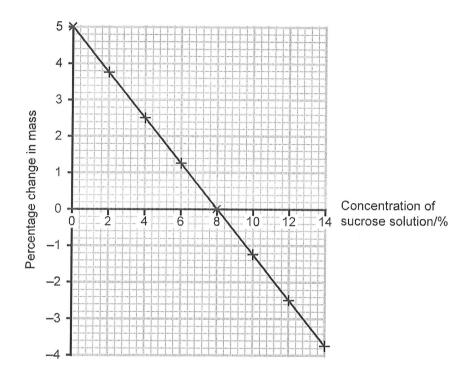
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3 A student recorded the mass of eight potato cylinders.

She placed one cylinder in each of eight concentrations of sucrose solution and left them for two hours.

She then reweighed the cylinders and calculated the percentage change in mass.

The graph shows her results.



(a) (i) Use the graph to find the percentage concentration of sucrose solution which gives zero percentage change in the mass of the potato cylinder.

_____% [1]

(ii) Explain your answer.

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(i) water (0% sucrose solution).(ii) 12% sucrose solution. Label the cell wall and cell me	embrane.
(i) cell in water	(ii) cell in 12% sucrose solution (Label the cell membrane and cell wall.)
What is the function of the plant ce	ell wall in osmosis?

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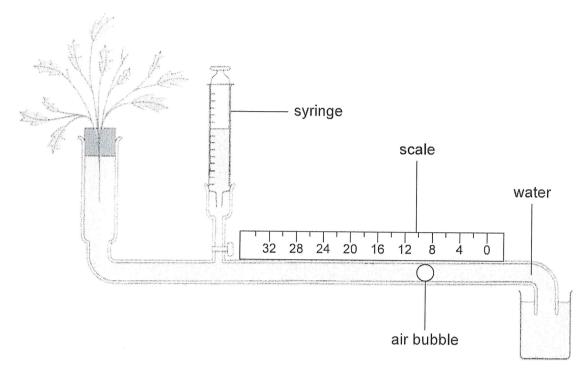


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QNOP (a) The diagram shows apparatus used to investigate the rate of transpiration in a plant shoot in different environmental conditions.

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		[1]
ii)	How is the bubble reset to zero between experiments?	
/		[1]
1)	Name the apparatus.	

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(b) The table shows the distance moved by the air bubble under different environmental conditions over **30 minutes**.

	Env	vironmental cor	ndition			Distance
Experiment	Fan speed on/off	Temperature /°C	Humidity low/high	Position of bubble at the start	Position of bubble at the end	moved by bubble/mm
1	off	20	low	8 4 0	8 4 0	4
2	on	20	low	8 4 0	8 4 0	6
3	off	30	low	8 4 0	8 4 0	
4	on	30	low	8 4 0	8 4 0	9

Complete the table by

(i)	drawing in	the position	of the air	r bubble at	t the end	of Experiment 2.	[1]]
-----	------------	--------------	------------	-------------	-----------	------------------	-----	---

(ii)	calculating the distance	e moved by the air bubble	e in Experiment 3.	[1]
. ,	0	,		L 2

(c)	What is	the	rate o	of trai	nspiration	in	Experiment	1	in	mm	per	hour	?
-----	---------	-----	--------	---------	------------	----	------------	---	----	----	-----	------	---

 mm	per	hour	[1]

(d)	(i)	The distance moved by the air bubble in Experiment 1 was 4 mm. The distance moved by the air bubble in Experiment 2 was 6 mm.
		Give the environmental condition that caused this increase.

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(ii)	Experiment 1 was repeated with high humidity. What would you expect to
	happen to the distance moved by the bubble?

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	the difference in Experiment 4.
i	In this question you will be assessed on your written communication skill including the use of specialist scientific terms.
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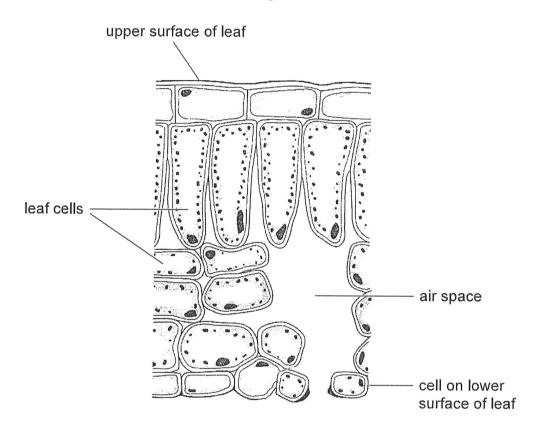
10 (a) Plants lose water from their leaves.

The water evaporates from the leaf cells and then diffuses out through stomata. Most plants have more stomata on the lower surface of their leaves.

(i) Name the process described above.

[1]

The diagram shows a section through a leaf.



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(ii) Use the information above and your knowledge to draw arrows on the diagram to show the pathway of water out of the leaf.

[2]

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(b) Water that is lost from leaves is usually replaced by water from the soil. In drought conditions water may not be available in the soil to replace the water lost.

Plants in desert regions have become adapted to survive long periods of drought.

The photograph shows quiver trees from the Namib desert in Africa.



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Suggest how dropping all of their leaves can help quiver trees to survive long periods of drought.	
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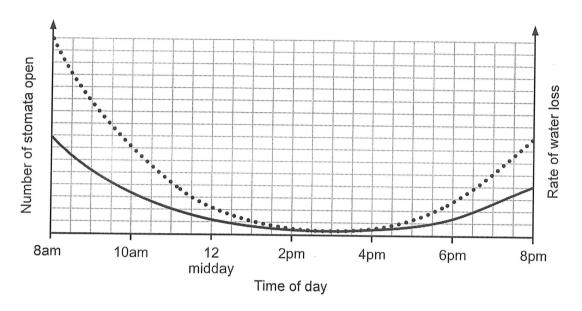




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(c) Another desert plant, called the unarmed saltwort, closes its stomata to prevent water loss.

The graph gives information about the number of stomata open and the rate of water loss in the unarmed saltwort over a 12 hour period.



Кеу:	
•••••• number of stomata open	rate of water loss

Source: Principal Examiner

Use the graph and your knowledge to answer the following questions.

(')	During which lour hour period is the least number of stomata open?	
	to	[1]

(ii)	Use the graph to describe the relationship between the number of stomata open and the rate of water loss in the plant.
	*

(III) Description of the second of the secon	
(iii) Draw a line on the graph to show the rate of water loss that would be	
expected if the stomata did not close over the 12 hour period.	[2]

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(iv)	Over a long period of time some species of desert plant became extinct as the desert became drier. The unarmed saltwort survived.
	Use your knowledge of natural selection to explain why the unarmed saltwort survived but these other species of desert plant became extinct.
,	[3]
	[0]
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