3. Movement into and out of cells

3.2 Osmosis

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates unless indicated in the question

1 **(b)** Describe **one** way that osmosis differs from other types of diffusion.

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..... [1]

2 **(b)** Table 2.2 shows some of the features of diffusion, osmosis and active transport.

Place ticks (✓) in the boxes to show the correct features of each process.

Table 2.2

	requires energy from respiration	takes place against a concentration gradient	always involves the movement of water	substances can cross the cell membrane
diffusion				
osmosis				
active transport				

[4]

3 **(c)** A student used a potato as a source of plant tissue. The student cut six cylinder-shaped pieces from the potato. Each potato cylinder had the same diameter.

Each potato cylinder was immersed in either water or one of five different concentrations of sugar solution.

The student measured the length of the potato cylinders before immersion and after being immersed for 30 minutes.

Table 1.1 shows the results.

Table 1.1

concentration of sugar solution / mol per dm^3	length of potato cylinder before immersion / mm	length of potato cylinder after immersion / mm	change in length of potato cylinder / mm
0.0	49.5	52.0	+ 2.5
0.2	50.0	52.0	+ 2.0
0.4	50.5	51.5	+ 1.0
0.6	50.5	51.0	+ 0.5
0.8	50.0	49.0	
1.0	50.0	48.5	– 1.5

(i) Use the information in Table 1.1 to calculate the change in length of the potato cylinder immersed in the 0.8 mol per dm^3 sugar solution.

..... mm [1]

(ii) Use the information in Table 1.1 to calculate the percentage increase in length of the potato cylinder immersed in the 0.2 mol per dm^3 sugar solution.

..... %
[2]

(d) State the name of the process that causes water to enter or leave the potato cells.

..... [1]

(e) Describe the expected change in appearance of a potato **cell** that was immersed in a 1.0 mol per dm^3 sugar solution. **(extended only)**

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..... [1]

4 **(b)** Substances can also move by osmosis and active transport.

Table 1.1 shows some of the features of diffusion, osmosis and active transport.

Complete Table 1.1 by placing **one** tick (✓) in each row to show the features of diffusion, osmosis and active transport.

One has been done for you.

Table 1.1

feature	diffusion	osmosis	active transport
involves movement of water only		✓	
always involves movement across a partially permeable membrane			
movement is from a higher solute concentration to a lower solute concentration			
requires energy from respiration			
involves the movement of both gases and solutes			

[4]

5 **(b)** Fig. 4.2 shows the same palisade mesophyll cell after it has been placed in a concentrated sugar solution for twenty minutes.

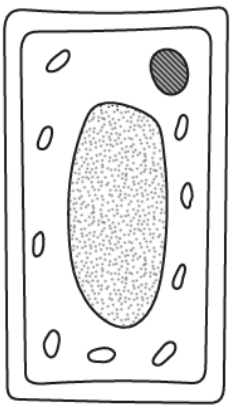

Fig. 4.1

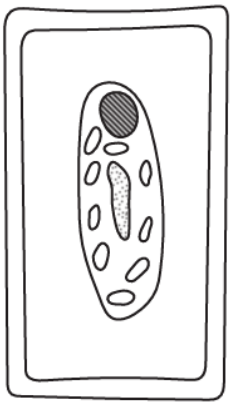

Fig. 4.2 **(extended only)**

(i) Describe the changes that have taken place in the cell between Fig. 4.1 and Fig. 4.2.

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..... [2]

(ii) Explain why the cell in Fig. 4.2 has changed. **(extended only)**

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..... [3]

(iii) Suggest how the cell in Fig. 4.2 could be treated so that it returned to its original appearance in Fig. 4.1. **(extended only)**

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..... [1]

6 **(a)** Three identical potato cylinders were used to investigate water movement in plant cells.

Cranberry juice is a red fruit juice that contains natural sugars.

Three test-tubes were set up as shown in Fig. 9.1 and left for one hour.

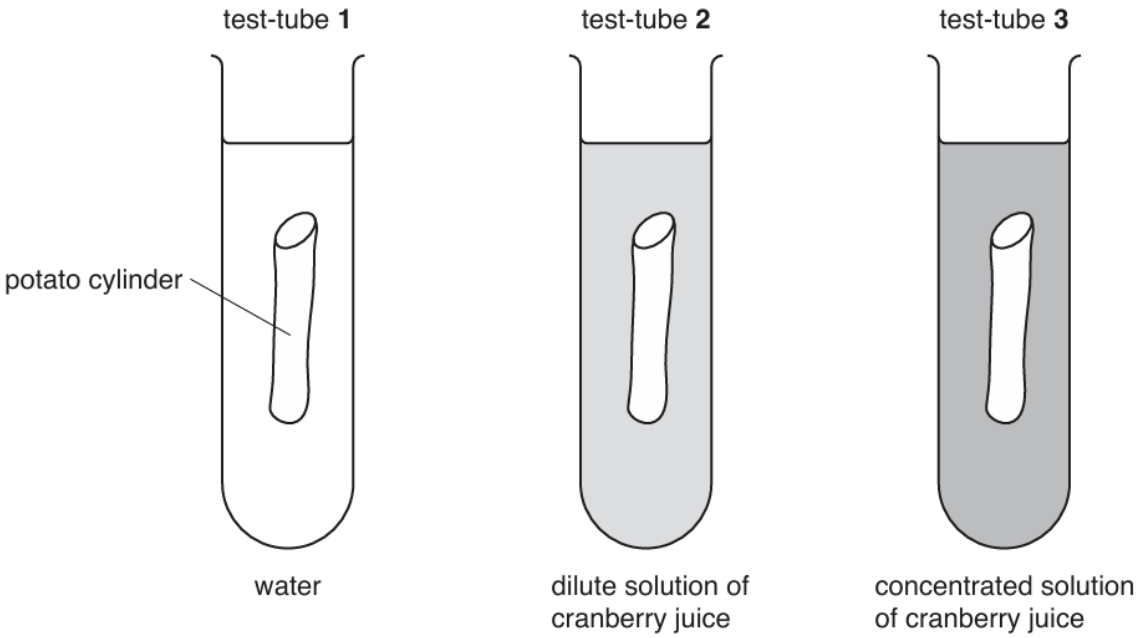

Fig. 9.1

After one hour the potato cylinders were removed from test-tubes **1** to **3**.

The mass of each potato cylinder is recorded in Table 9.1.

Table 9.1

test-tube number	mass of the potato cylinder at the start / g	mass of the potato cylinder after one hour / g
1	25	30
2	25	25
3	25	19

(i) Describe the results for test-tubes **1** and **2**.

test-tube **1** .....

.....

test-tube **2** .....

.....

[2]

(ii) Calculate the decrease in the mass of the potato cylinder in test-tube **3**.

..... g [1]

(iii) Explain why the potato cylinder lost mass in test-tube **3**.

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..... [2]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

7 **(c)** Some students investigated the effect of immersing red blood cells in different concentrations of salt solution.

They measured the diameters of samples of red blood cells and calculated the mean.

They then immersed each red blood cell sample in a different concentration of salt solution.

After two minutes they measured and calculated the mean of the samples again.

Table 1.1 shows the results.

Table 1.1

percentage concentration of the salt solution	mean initial diameter of the red blood cells / μm	mean diameter of the red blood cells after two minutes / μm
0.4	7.5	cells burst
0.8	7.5	8.2
0.9	7.5	7.5
1.8	7.5	6.0

(i) Calculate the percentage increase in the mean diameter of red blood cells that were immersed in the 0.8% salt solution.

Give your answer to **two** significant figures.

Space for working.

..... %
[3]

(ii) Explain the results for the red blood cells that were immersed in the 1.8% salt solution.

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..... [3]

(iii) State why there was no change in the mean diameter of the red blood cells immersed in the 0.9% salt solution.

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..... [1]

(d) State why red blood cells burst when immersed in pure water but plant cells do not.

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..... [1]

(e) State **two** uses of water in a plant.

1 .....

2 .....

[2]

8 **(a)** A student investigated osmosis in potato plant cells.

He immersed cubes of potato tissue in water and different concentrations of sucrose solution for 30 minutes.

The masses of the potato cubes were measured before and after immersion.

The percentage changes in mass were calculated.

Table 2.1 shows the results.

Table 2.1

concentration of sucrose solution / mol dm^{-3}	mass of potato cube before immersion / g	mass of potato cube after immersion / g	percentage change in mass
0.00	1.32	1.50	13.64
0.20	1.34	1.49	11.19
0.40	1.30	1.34	3.08
0.60	1.33	1.29	–3.01
0.80	1.22	1.12	–8.20
1.00	1.28	1.11	

(i) Using the information in Table 2.1, calculate the percentage change in mass at 1.00 mol dm^{-3}.

Give your answer to **two** decimal places.

Space for working.

(ii) Using the information in Table 2.1, explain the difference in the results between the 0.6 mol dm^{-3} and the 0.8 mol dm^{-3} sucrose solutions.

Use the term water potential in your answer. **(extended only)**

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..... [5]

(iii) Describe the expected appearance of a cell from a potato cube that has been immersed in distilled water for 30 minutes. **(extended only)**

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..... [2]

9 Water is an essential molecule for life.

(a) Complete the statements.

Water moves into and out of cells by ..... .

Water is known as a ..... because it can dissolve solutes.

[2]

(b) A leaf cell was put into a solution. The water potential of the solution was lower than the water potential of the contents of the cell.

Fig. 1.1 is a sketch of the cell after three hours in the solution.

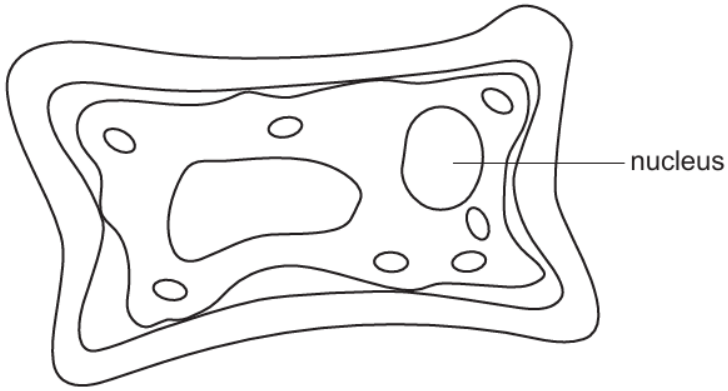

Fig. 1.1

The leaf cell was transferred into pure water.

Sketch the expected appearance of the cell after it had been in the pure water for three hours.

Draw **one** arrow on your sketch to show the direction of water movement.

(c) A plant was **not** watered for one week. **(extended only)**

Fig. 1.2 shows a series of photographs of the plant during the week.

day 0 day 3 day 7

Fig. 1.2

Explain how the lack of water has affected the support of the leaves of the plant shown in Fig. 1.2.

Use the term *turgor pressure* in your answer.

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..... [3]