Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Movement into and out of cells

Time allowed: 1 hour 25 minutes

Subject code **0610**

Biology

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 89

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 89 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 **(a)** Complete Table 5.1 to show which statements are true for diffusion and which are true for osmosis. Use a tick (✓) if it is true or a cross (✗) if it is false.

Complete all eight boxes.

Table 5.1

statement	diffusion	osmosis
must involve a partially permeable membrane		
involves the movement of gases and solutes		
is a result of the random movement of particles		
requires energy from respiration		

[4]

(b) Fig. 5.1 shows a small bag of coloured salts placed in a beaker of warm water.

After a few minutes, the water changes colour. This is shown in Fig. 5.1.

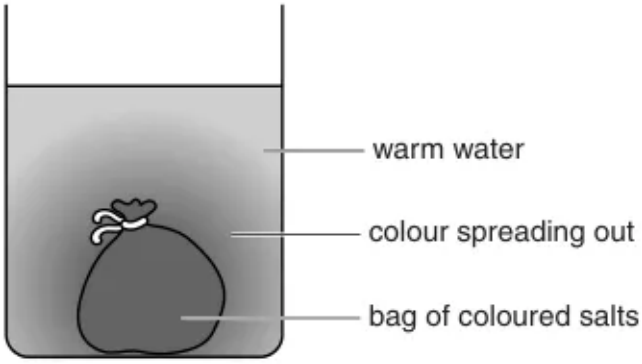


Fig. 5.1

Use Fig. 5.1 to help explain how tissues obtain oxygen from the blood.

.....

.....

.....

.....

.....[2]

[Total: 6]

Diffusion Click for more variations

1 **(a)**	<table><tr><th>diffusion</th><th>osmosis</th></tr><tr><td>X</td><td>✓ ;</td></tr><tr><td>✓</td><td>X ;</td></tr><tr><td>✓</td><td>✓ ;</td></tr><tr><td>X</td><td>X ;</td></tr></table>	[4]	1 mark for each correct row
(b)	movement (of oxygen) from high to low concentration ; random movement of particles ; (identification of this as) diffusion ; water acting as solvent ;	[max 2] **[Total: 6]**	

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2 **(a)** Complete Table 6.1 about diffusion and active transport.

Place a tick (✓) in each box which is correct.

Table 6.1

process	involves the movement of particles down a concentration gradient	involves the movement of particles up a concentration gradient	energy from respiration is required to move the particles
diffusion			
active transport			

[2]

(b) Complete Table 6.2 by naming the organ where each of these examples of diffusion takes place.

Table 6.2

example of diffusion	organ
oxygen passes into the blood of a human	
carbon dioxide passes into a plant	
glucose is absorbed into the blood of a human	

[3]

(c) Water moves into plant cells by osmosis.

Explain how plants benefit from the build-up of water in their cells.

.....

.....

..... [1]

[Total: 6]

Diffusion Click for more variations

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2(a)	<table><tr><th>process</th><th>involves the movement of particles down a gradient</th><th>involves the movement of particles up a gradient</th><th>energy is required to move the particles</th></tr><tr><td>diffusion</td><td>✓</td><td></td><td></td></tr><tr><td>active transport</td><td></td><td>✓</td><td>✓</td></tr></table>	**2**	3 correct ticks = 2 marks 1 or 2 correct ticks = 1 mark

2(b)	lungs / alveoli; leaf / stoma(ta); small intestine / ileum / duodenum;	**3**	 **A** stomach / liver / kidney / muscle / AVP
2(c)	provides support / turgid / AW;	**1**	
		Total: 6	

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3 Fig. 2.1 shows a plant cell after it has been in a solution of glucose for fifteen minutes.

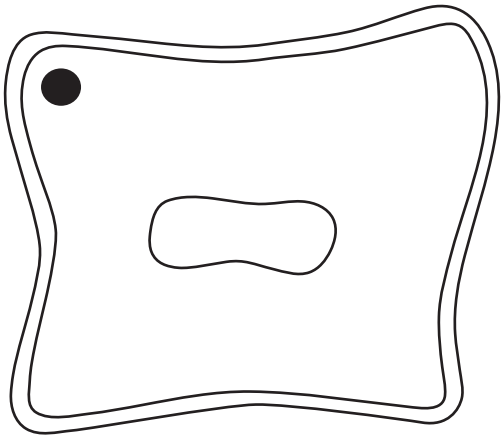


Fig. 2.1

(a) Draw label lines **on Fig. 2.1** to link each label to the correct structure. [3]

(b) The plant cell in Fig. 2.1 was then placed in distilled water.

Fig. 2.2 shows the appearance of the cell after fifteen minutes in distilled water.

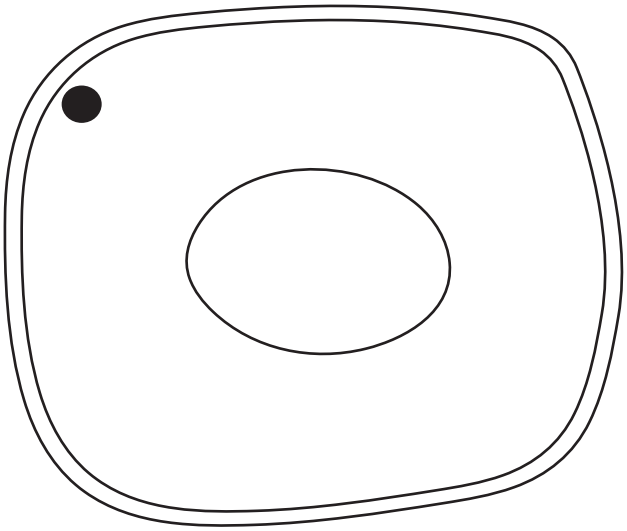


Fig. 2.2

(i) State **two** ways in which the plant cell has changed.

1 .....

.....

2 .....

.....

[2]

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(ii) Explain why the plant cell changed when it was placed in distilled water.

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

Cell structure: plant, animal and bacterial cells Click for more variations

Reduced to 78% to fit the page (wider than A4).

3(a)	line ending on cell membrane ; line ending in the cytoplasm ; line ending on or in the vacuole ;	3	
3(b)(i)	1 cell, is larger / has expanded / has changed shape / AW ; 2 cytoplasm has increased in volume ; 3 vacuole, is larger / AW ; 4 cell wall / cell membrane, is, stretched / AW ;	2	
3(b)(ii)	1 water moves into the, cell / vacuole ; *max two from:* 2 ref. to osmosis ; 3 through partially permeable membrane ; 4 cell or vacuole contents / cytoplasm , more concentrated than (distilled) water / AW ;	3	

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4 **(a)** Water is an important biological molecule.

The box on the left contains the word 'Water'.

The boxes on the right contain some sentence endings.

Draw a line from the box on the left to each correct statement about water.

Draw **three** lines.

Water	breaks down to release energy.
	dissolves many substances.
	is a solute.
	is produced in photosynthesis.
	is required for digestion.
	is required for germination.

[3]

(b) Students investigated the movement of water in model animal cells using dialysis tubing.

Fig. 1.1 is a diagram of the apparatus used in the investigation.

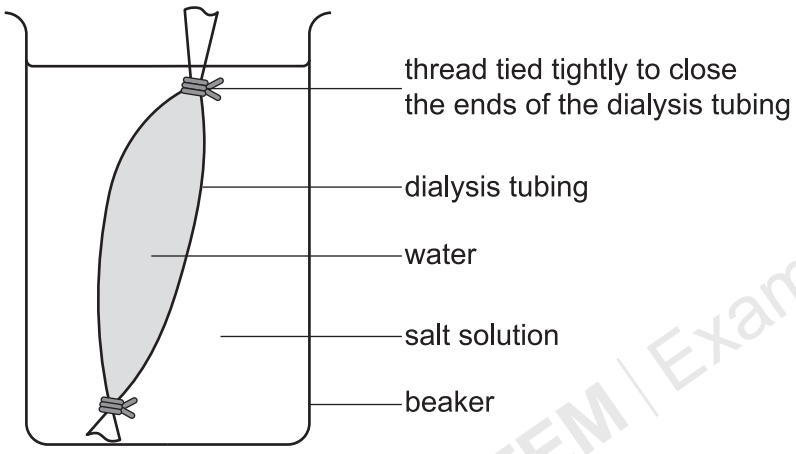


Fig. 1.1

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(i) State the name of the part in Fig. 1.1 which represents:

the partially permeable membrane of an animal cell

.....

the cytoplasm of an animal cell.

.....

[2]

(ii) Draw an arrow **on Fig. 1.1** to show the direction of water movement during the investigation.

[1]

(iii) State the name of the process of water diffusing across a partially permeable membrane.

..... [1]

(c) Animal cells placed in pure water will burst.

State the structure that prevents a **plant** cell from bursting when it is placed in pure water.

..... [1]

[Total: 8]

Osmosis Click for more variations

Reduced to 77% to fit the page (wider than A4).

4(a)	Water → breaks down to release energy. ✗ Water → dissolves many substances. ✓ Water → is a solute. ✓ Water → is produced by photosynthesis. ✗ Water → is required for digestion. ✗ Water → is required for germination. ✗ ;;;	**3**	one mark for each correct line **R** each additional line
4(b)(i)	*membrane:* (dialysis) tubing ; *cytoplasm:* water ;	**2**	
4(b)(ii)	arrow starting from water (inside tubing), crossing dialysis tubing and ending in salt solution ;	**1**	
4(b)(iii)	osmosis ;	**1**	
4(c)	(cell) wall ;	**1**	

STEM | Exam Builder

5 **(a)** Fig. 9.1 represents two liquids, **A** and **B**, separated by a partially permeable membrane.

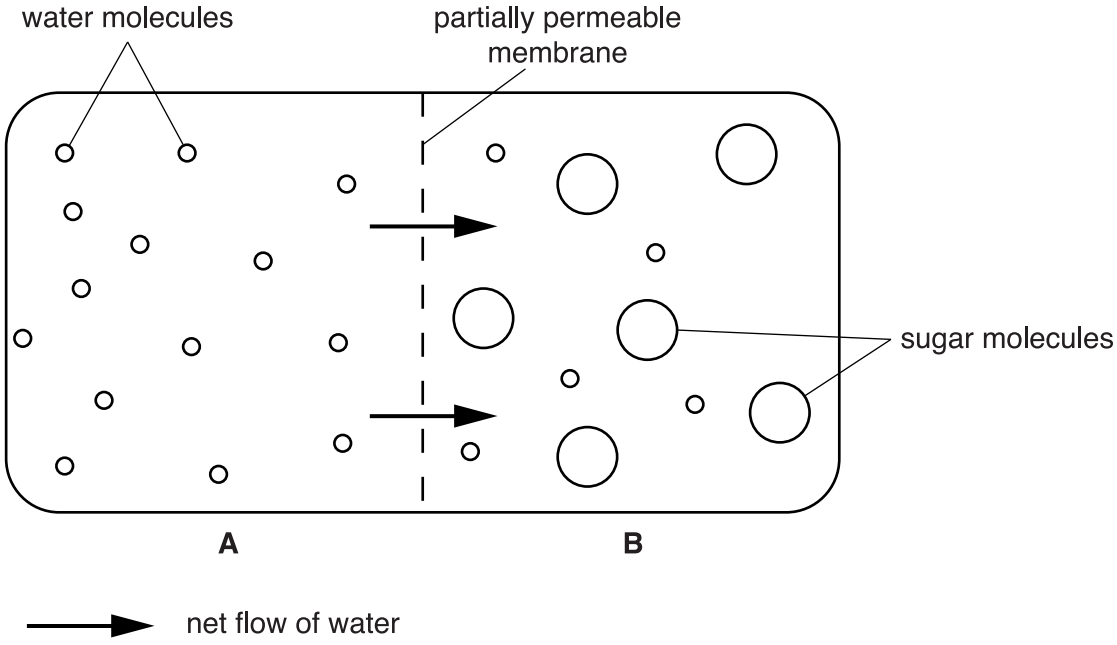


Fig. 9.1

A is pure water and **B** is a sugar solution.

In the human alimentary canal, water moves from the colon into the blood.

Use the information in Fig. 9.1 to explain the movement of water from the colon into the blood.

.....

.....

.....

.....

.....

.....

.....[3]

STEM | Exam Builder

(b) The ratio of the surface area to the volume of a cell affects the rate of diffusion of a substance into the cell.

The results of an investigation on diffusion into a cube-shaped cell are shown in Table 9.1.

(i) Complete Table 9.1. One of the rows has been done for you.

Table 9.1

length of side of cube /mm	time taken for substance to diffuse to centre of cell /s	surface area of cube /mm^2 (total of 6 sides)	volume of cube /mm^3	surface area to volume ratio
1	20	6	1	6:1
2	41			
3	76			

[2]

(ii) Suggest how surface area to volume ratio affects the efficiency of diffusion.

.....

.....

.....[1]

(c) Explain **one** way that the lungs of a mammal are adapted to increase the rate of diffusion of oxygen from the alveoli to the blood.

.....

.....

.....

.....

.....[2]

[Total: 8]

Osmosis Click for more variations

STEM | Exam Builder

<table>
<tr><td>5 (a)</td><td>(water moves by) osmosis / diffusion ;
down a (water potential) gradient/ from a high concentration of water to a low concentration of water ;
lower water potential / AW in the blood ;
colon has a high concentration of water / blood has a low concentration of water ;
because the membrane is partially permeable ;</td><td>max [3]</td><td></td></tr>
<tr><td>(b) (i)</td><td><table>
<tr><th>length</th><th>time</th><th>surface area</th><th>volume</th><th>sa to volume ratio</th></tr>
<tr><td>2</td><td>41</td><td>24</td><td>8</td><td>3:1 ;</td></tr>
<tr><td>3</td><td>76</td><td>54</td><td>27</td><td>2:1 ;</td></tr>
</table></td><td>[2]</td><td>1 mark for each correct line
A if just ratio stated</td></tr>
<tr><td>(ii)</td><td>as surface area to volume ratio falls the efficiency of diffusion falls / time taken for diffusion increases / ora ;</td><td>[1]</td><td></td></tr>
<tr><td>(c)</td><td>many air sacs / alveoli ;
to increase / large surface area ;
idea of extensive blood supply ;
to remove absorbed materials ;
one cell thick ;
short diffusion distance ;</td><td>max [2]</td><td></td></tr>
<tr><td></td><td></td><td>[Total: 8]</td><td></td></tr>
</table>

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6 **(a)** The movement of molecules within an organism can occur by diffusion and active transport.

Complete Table 1.1 by placing ticks (✓) to show the correct features of each process.

Table 1.1

feature	active transport	diffusion
movement of particles always occurs across a cell membrane		
movement of molecules during gas exchange		
rate of movement of particles is higher when the concentration gradient is larger		
requires energy from respiration		

[4]

(b) Explain why active transport is important in root hair cells.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

Diffusion Click for more variations

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6(a)

feature	active transport	diffusion
movement of particles always occurs across a cell membrane	✓ ;	
molecules moving during gas exchange		✓ ;
rate of movement of particles is higher when the concentration gradient is larger		✓ ;
requires energy from respiration	✓ ;	

4 one mark per correct row
R each additional tick

6(b)

any three from:
for ion, uptake / absorption ;
ion concentration lower in the soil than in the root (cell) / AW ;
movement against the concentration gradient / AW ;
creates a water potential gradient / AW ;
named example of ion e.g. nitrate / magnesium ;

3

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7 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.

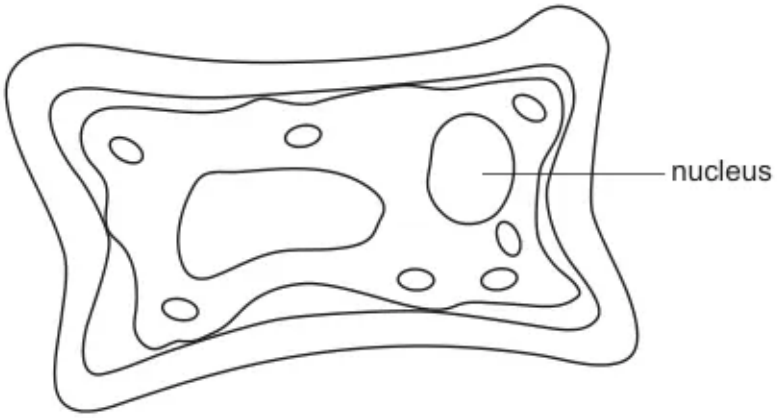


Fig. 1.1

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.

[3]

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

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.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

Osmosis Click for more variations

STEM

7(a)	osmosis ; solvent ;	**2**	
7(b)	*drawing with:* arrow showing water movement into cell ; *max. two from:* no space between cell membrane and cell wall ; cell wall, slightly bent outwards / straight ; vacuole larger in proportion than in Fig 1.1 ;	**3**	
7(c)	wilting ; lack of turgor pressure (at the end of the week) ; **ora** no longer a push against cell wall / AW ; **ora** (mesophyll) cells not providing support / cell collapses / AW ; (lack of water means cells become) flaccid / plasmolyse ;	**3**	

STEM | Exam Builder

8 Some students investigated osmosis in raw potato sticks.

(a) Define the term *osmosis*.

.....

.....

.....

.....

.....

.....

..... [3]

(b) The students measured the mass of four of the potato sticks using an electronic balance.

Fig. 4.1 shows an electronic balance.



Fig. 4.1

The students left each potato stick in one of four different liquids for 5 hours:

- distilled water
- 0.1 mol per dm^3 sodium chloride solution
- 0.5 mol per dm^3 sodium chloride solution
- 1.0 mol per dm^3 sodium chloride solution.

After 5 hours they measured the mass again and calculated the change in mass.

(i) Predict which of the liquids would cause the largest decrease in mass of a potato stick.

..... [1]

(ii) The students dried the potato sticks with paper towels before putting them on the electronic balance.

Suggest why.

.....

.....

..... [1]

(c) After the experiment the students noticed that the potato stick with the lowest mass was soft and floppy.

Explain why the potato stick had become soft and floppy.

.....

.....

.....

.....

.....

.....

..... [3]

(d) The students followed the same experimental procedure with boiled potato sticks and found no overall change in mass in any of the solutions.

Suggest why the mass of the boiled potato sticks remained the same.

.....

.....

.....

.....

..... [2]

[Total: 10]

Osmosis Click for more variations

8 **(a)**	movement / diffusion, of water (molecules) ; from high water potential to low water potential / down water potential gradient ; across a partially permeable membrane ;	[3]	
(b) (i)	1.0 (mol dm^{-3} sodium chloride solution) ;	[1]	
(ii)	(to remove) excess / surface / AW, water / AW, on potato sticks ; to measure the mass of the potato (stick) only ;	[max 1]	**I** inaccurate unqualified **R** dry mass
(c)	cells / potato sticks, have lost water (by osmosis) ; from high water potential to low water potential / down water potential gradient ; (cells / tissue / potato) were, plasmolysed / flaccid ; loss of turgor (pressure) ; not enough pressure of water pushing on cell walls ;	[max 3]	**I** water concentration **I** incipient (plasmolysis) **A** reduced turgidity / description
(d)	protein denatured (when cooked) ; cell membrane, damaged / destroyed (when cooked) ; no osmosis will occur ;	[max 2]	**R** killed proteins **I** killed / denatured, cells **I** damaged cell wall
		[Total: 10]	

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9 *Rhabdostyla* is a single-celled organism that has no cell wall and no chlorophyll.

(a) Gases are exchanged across the cell membrane of *Rhabdostyla*.

Name:

the gas produced by *Rhabdostyla* .....

the process that produces the gas .....

the method of removal of the gas .....

[3]

Rhabdostyla lives in freshwater habitats, such as ponds, lakes and rivers.

Freshwater has a very low concentration of solutes.

Rhabdostyla has a contractile vacuole that fills with water and empties at intervals as shown in Fig. 4.1. The contractile vacuole removes excess water.

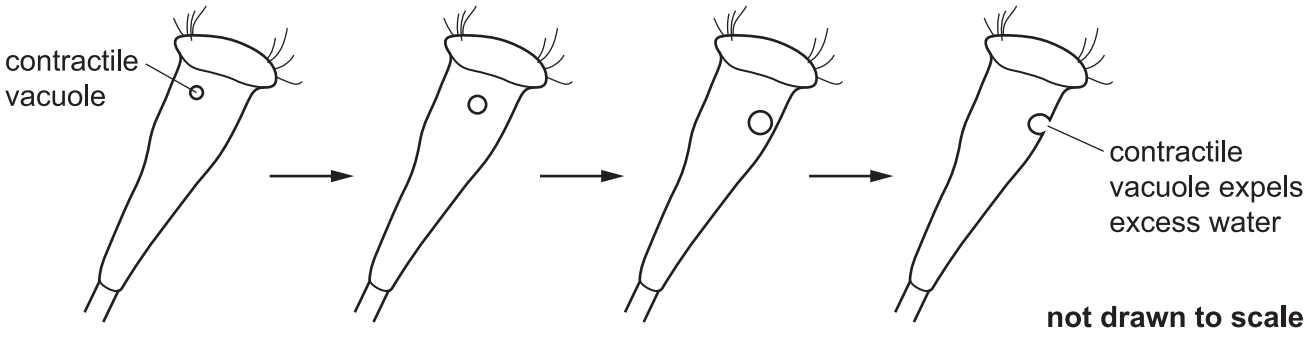


Fig. 4.1

(b) Explain, using the term **water potential**, why *Rhabdostyla* needs to remove excess water.

.....

.....

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.....

.....

.....

..... [3]

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In an investigation, individual *Rhabdostyla* were placed into different concentrations of sea water. The rate of water excreted by the contractile vacuole of each organism was determined. The results are shown in Fig. 4.2.

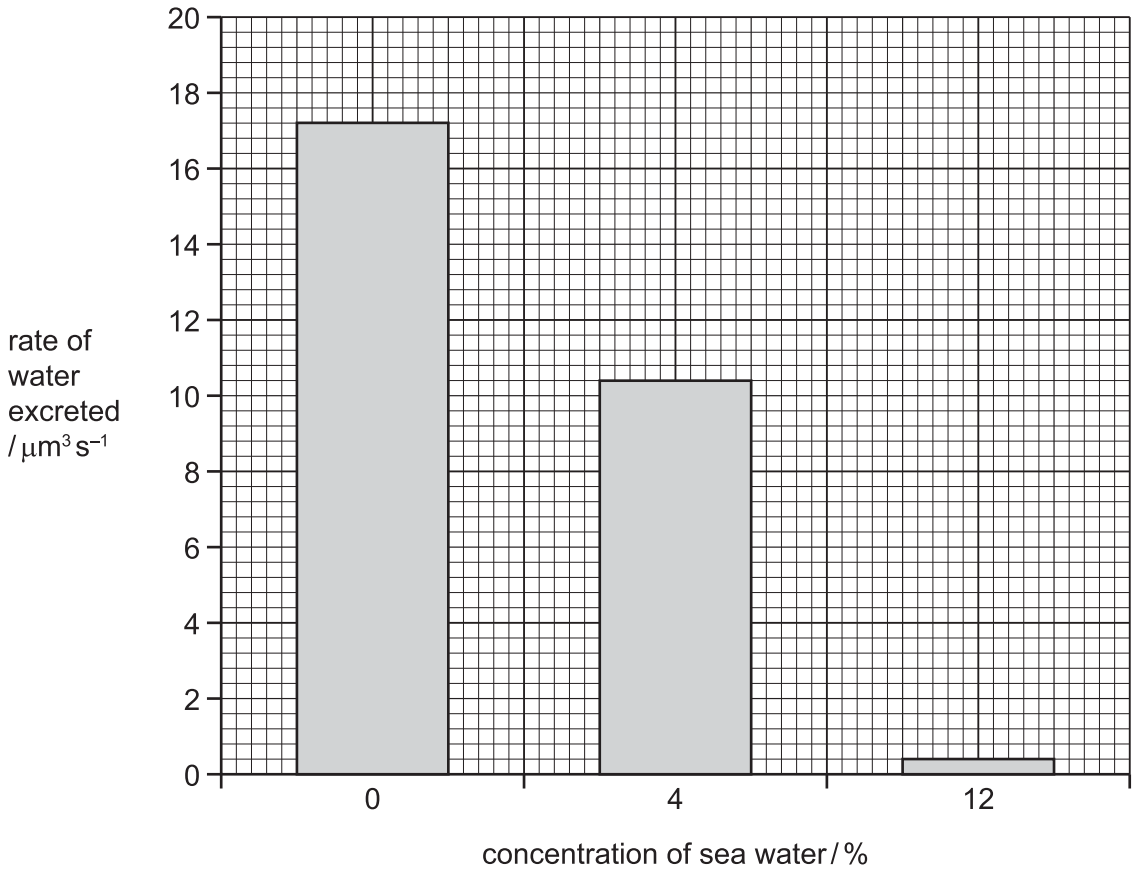


Fig. 4.2

(c) Explain the results shown in Fig. 4.2.

.....

.....

.....

.....

.....

.....

..... [3]

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(d) Single-celled organisms with cell walls do not have contractile vacuoles. Suggest why.

.....

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.....

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.....

.....

..... [3]

[Total: 12]

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Osmosis Click for more variations

9	**(a)**	carbon dioxide / CO_2 ; (aerobic) respiration ; (simple) diffusion ;	[3]	**A** excretion **I** gas exchange
	(b)	water enters by <u>osmosis</u> ; down a <u>water potential</u> gradient / high(er) to low(er) <u>water potential</u> ; through partially permeable membrane ; needs to remove water to prevent bursting ;	[max 3]	**R** water concentration **A** semi- / selectively / differentially
	(c)	as concentration of sea water increases the removal of water decreases ; as concentration of sea water increases the water potential gradient decreases ; therefore less water enters at higher concentrations of sea water ; less excess water ;	[max 3]	**A** 0% to 12%
	(d)	cell walls, inelastic / do not stretch / rigid / inflexible / keep shape of cell ; cells, are turgid / have high turgor pressure ; resist any increase in, volume / pressure ; these cells do not absorb excess water ; the cells will not burst ;	[max 3]	**I** strong / tough / don't break **A** (very) little water enters
			[Total: 12]	

STEM | Exam Builder

10 Fig. 1.1 shows the movement of particles through an epithelial cell in the small intestine.

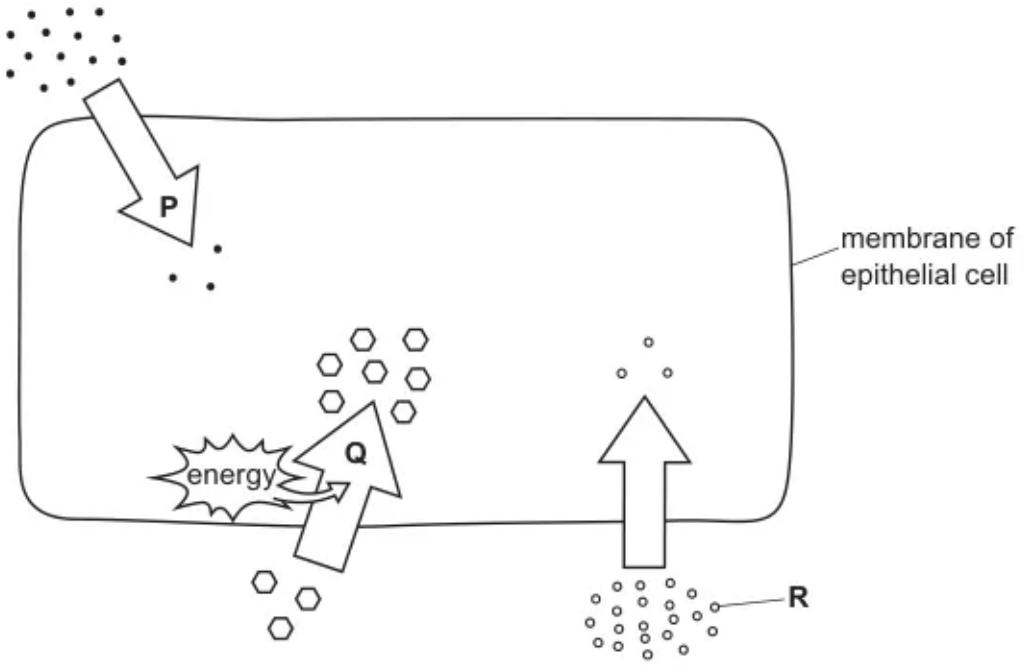


Fig. 1.1

(a) In Fig. 1.1, arrow **P** represents the diffusion of oxygen molecules.

(i) Describe what is meant by the term diffusion.

.....

.....

.....

.....

..... [2]

(ii) State the type of energy needed for diffusion.

..... [1]

(b) Carbon dioxide molecules also move by diffusion.

(i) State the name of the process in human cells that produces carbon dioxide.

..... [1]

(ii) On Fig. 1.1, draw an arrow to show the direction of diffusion of carbon dioxide molecules. [1]

(c) In Fig. 1.1, arrow **Q** represents another type of particle movement.

Identify the type of particle movement represented by arrow **Q**.

Explain your answer.

type of movement .....

explanation .....

.....

.....

[3]

(d) In Fig. 1.1, particle **R** moves from the lumen of the small intestine into the epithelial cell.

Suggest why particle **R cannot** be starch.

.....

.....

.....

..... [2]

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(e) Fig. 1.2 is a photomicrograph of red onion cells.

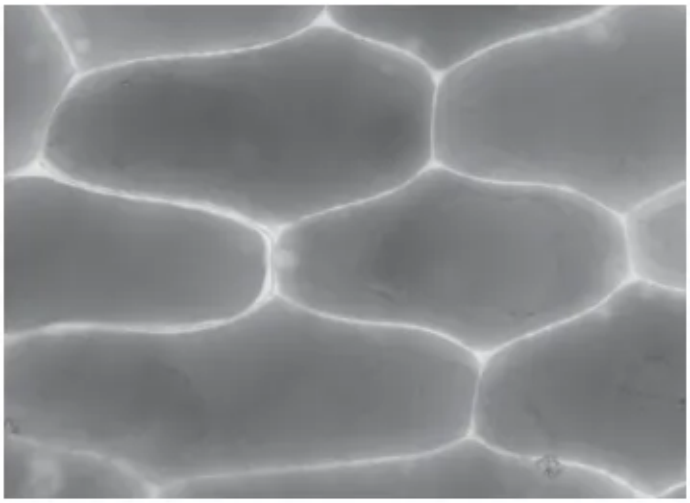


Fig. 1.2

Fig. 1.3 is a photomicrograph of the same red onion cells after being immersed in a salt solution.

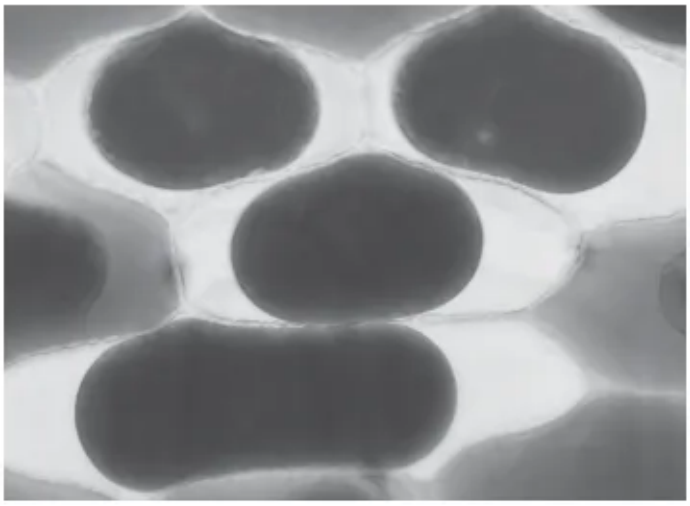


Fig. 1.3

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Using Fig. 1.2 and Fig. 1.3, describe **and** explain the difference in appearance of the cells before and after immersion in salt solution.

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..... [6]

[Total: 16]

Osmosis Click for more variations

STEM | Exam Builder

10(a)(i)	net movement / AW, of particles ; from a region of higher concentration to a region of their lower concentration (as a result of their random movement) ;	**2**	
10(a)(ii)	kinetic (energy) ;	**1**	
10(b)(i)	aerobic respiration ;	**1**	
10(b)(ii)	arrow drawn from inside to outside of epithelial cell ;	**1**	
10(c)	*type:* active transport ; *explanation:* (particles move from) low(er) concentration to high(er) concentration ; uses energy ;	**3**	
10(d)	*any two from:* starch is insoluble ; starch is (too) large ; starch has already been broken down / AW ;	**2**	
10(e)	*any six from:* 1 *idea of* before immersion cells are turgid / *idea of* after immersion cells are flaccid **or** plasmolysed ; 2 *idea of* before immersion cell membrane **or** cytoplasm pushes against cell wall / *idea of* after immersion cell membrane **or** cytoplasm pulls away from cell wall ; 3 *idea of* before immersion increased turgor pressure / *idea of* after immersion decreased turgor pressure ; 4 ref to osmosis ; 5 salt solution is concentrated **or** has a lower water potential / cytoplasm is dilute **or** has a higher water potential ; 6 water moves from high water potential to low water potential ; 7 through a partially permeable membrane ; 8 cytoplasm / vacuole / cell contents, is darker (after immersion) / ora ; 9 cytoplasm / vacuole / cell contents, are more concentrated (after immersion) / ora ;	**6**	

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