

Week 4

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

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IGCSE Biology

Name: _____ Score: _____

1. Diffusion is the net movement of particles from a region of:
 - ☐ high concentration to low concentration
 - ☐ low concentration to high concentration
 - ☐ high pressure to low temperature
 - ☐ one cell to an identical cell
2. Osmosis is the net movement of:
 - ☐ water from a dilute to a concentrated solution, through a partially permeable membrane
 - ☐ any particle from high to low concentration
 - ☐ water using energy
 - ☐ salt into a cell
3. Active transport moves particles:
 - ☐ from low to high concentration, using energy
 - ☐ from high to low concentration, no energy
 - ☐ only water
 - ☐ without any membrane
4. Diffusion requires energy from the cell.
 - ☐ True ☐ False
5. An animal cell placed in pure water will:
 - ☐ gain water and may burst
 - ☐ lose water and shrink
 - ☐ stay exactly the same
 - ☐ gain salt
6. The energy for active transport comes from:
 - ☐ respiration
 - ☐ sunlight directly
 - ☐ diffusion
 - ☐ osmosis

7. Which increase the rate of diffusion? (Select all that apply.)

- ☐ a steeper concentration gradient
- ☐ a higher temperature
- ☐ a larger surface area
- ☐ a thicker barrier

Tick every correct option.

8. Osmosis requires energy from the cell.

- ☐ True ☐ False

9. Diffusion and osmosis are passive (no energy), while active transport needs energy.

- ☐ True ☐ False

10. Diffusion is the _____ movement of particles down a concentration gradient.

IGCSE Biology

1. **high concentration to low concentration**

Particles move down the concentration gradient.

2. **water from a dilute to a concentrated solution, through a partially permeable membrane**

Osmosis is specifically water across a partially permeable membrane.

3. **from low to high concentration, using energy**

Active transport goes against the gradient and needs energy.

4. **False**

Diffusion is passive — it needs no energy from the cell.

5. **gain water and may burst**

Water enters by osmosis, swelling the cell.

6. **respiration**

Respiration releases the energy used.

7. **a steeper concentration gradient; a higher temperature; a larger surface area**

A thicker barrier slows diffusion; the others speed it up.

8. **False**

Like diffusion, osmosis is passive.

9. **True**

Only active transport requires energy.

10. **net**

Particles move both ways, but the net flow is high to low.

3.1 Diffusion

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS diffusion 扩散 • concentration 浓度 • ions 离子 • temperature 温度 • particles 粒子

Objective

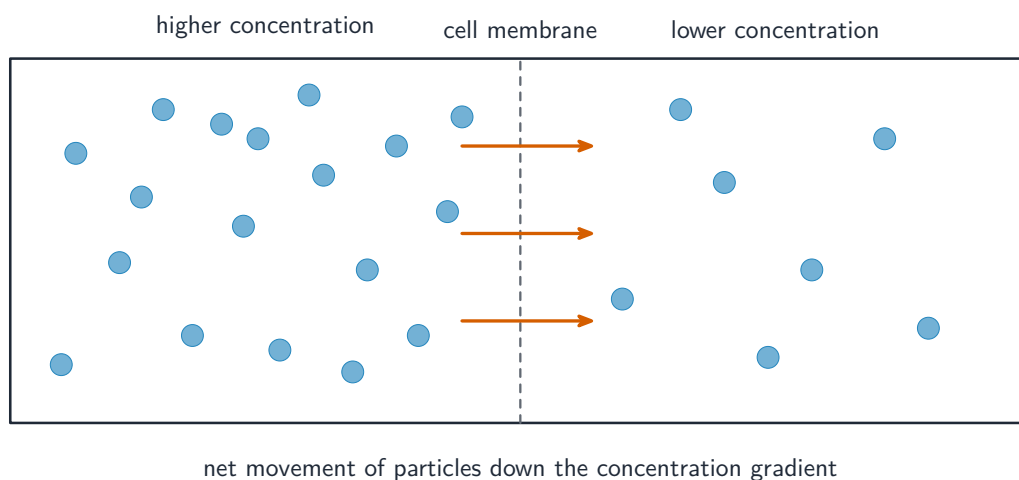
Build the skills to answer exam questions on **diffusion** 扩散 — the definition, why no energy is needed, and the factors affecting its rate.

You must be able to:

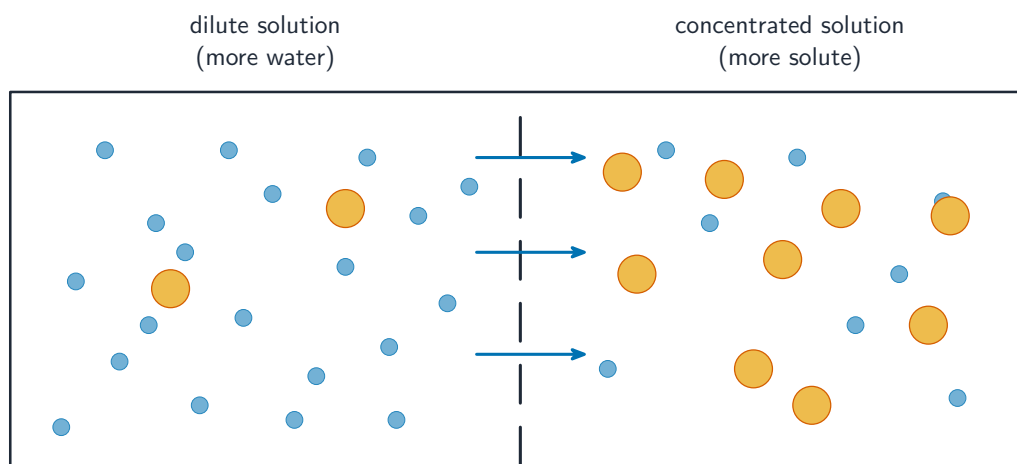
- define diffusion (net movement down a concentration gradient)
- state where the energy comes from
- give the factors that affect the rate of diffusion

1 Worked examples

■ Diffusion



Diffusion: net movement of particles from higher to lower concentration (down the gradient)



water moves by osmosis to the concentrated side; solute is too big to cross

Osmosis is the diffusion of water across a membrane

- **no extra energy** — uses the particles' own random (kinetic) movement.
- **faster when:** larger surface area, higher temperature, steeper gradient, shorter distance.
- e.g. O_2 diffuses into cells, CO_2 diffuses out.

2 Practice

2.1 Define diffusion.

[2]

2.2 State where the energy for diffusion comes from.

[1]

3 Exam-style questions

3.1 Diffusion is faster when the temperature is: [1]

- **A** lower
 - **B** higher
 - **C** at freezing point
 - **D** it has no effect
-

3.2 Oxygen moves from the air in the alveoli into the blood.

(a) Name the process. [1]

(b) State two factors that would increase the rate of this movement. [2]

3.3 Explain why diffusion does not require energy from respiration. [2]

Solutions

2.1 the net movement of particles from a region of higher concentration to a region of lower concentration, down a concentration gradient.

2.2 the kinetic energy of the random movement of the particles.

3.1 B. Higher temperature makes particles move faster, so diffusion is faster.

3.2 (a) diffusion.

(b) any two of: larger surface area; higher temperature; steeper concentration gradient; shorter distance.

3.3 the particles move using their own random (kinetic) energy; so no extra energy from respiration is needed.

- 5** Diffusion may be defined as the net movement of particles from a region of their1..... concentration, to a region of their2..... concentration, where movement is3..... a concentration gradient.

Which words complete gaps 1, 2 and 3?

	1	2	3
A	higher	lower	down
B	higher	lower	up
C	lower	higher	down
D	lower	higher	up

1 A student investigated the effect of concentration on diffusion.

The student used pieces of agar which contained universal indicator. Universal indicator is green in substances with a neutral pH and red in substances with an acidic pH.

The student placed the pieces of agar into different concentrations of hydrochloric acid solution and measured the time taken for the acid to diffuse to the centre of each piece of agar. At the start of the investigation the agar was green.

The student used this method:

Step 1 Label four test-tubes **0.4, 0.6, 0.8, 1.0**.

Table 1.1 shows the volumes of 1.0 mol per dm³ hydrochloric acid solution and distilled water used to make the different concentrations of hydrochloric acid solution.

Table 1.1

concentration of hydrochloric acid solution / mol per dm ³	volume of 1.0 mol per dm ³ hydrochloric acid solution / cm ³	volume of distilled water / cm ³
0.4	4	6
0.6	6	4
0.8	8	2
1.0	10	0

Step 2 Use a 10 cm³ syringe to put the volumes of 1.0 mol per dm³ hydrochloric acid solution shown in Table 1.1 into the test-tubes labelled **0.4, 0.6, 0.8, 1.0**.

Step 3 Use the 10 cm³ syringe to put the volumes of distilled water shown in Table 1.1 into the test-tubes labelled **0.4, 0.6, 0.8, 1.0**.

Step 4 A block of agar which measures approximately 1 cm × 2 cm × 2 cm is provided. Use the knife to cut the agar block into four pieces.

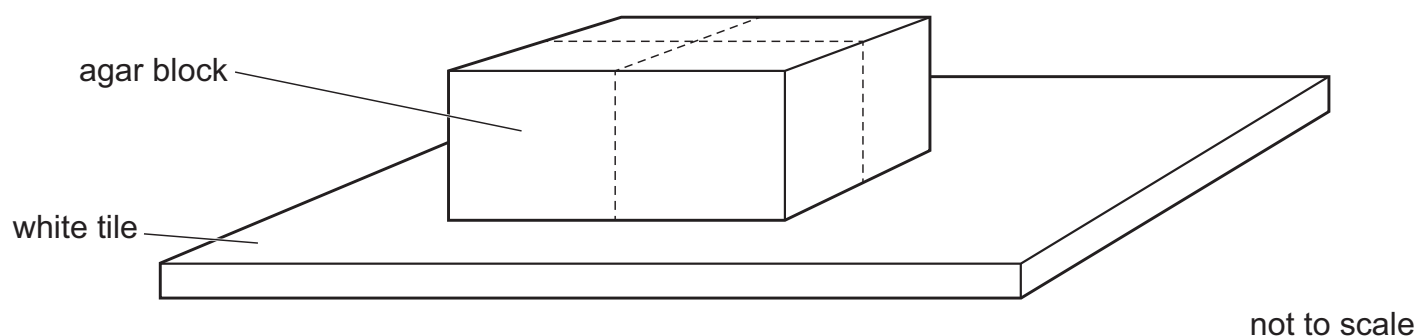


Fig. 1.1

Step 5 Place all the test-tubes into a warm water-bath.

Step 6 Put **one** agar piece into each of the test-tubes and immediately start the stop-clock. Observe the colour of the agar pieces as they change from green to red.

The student recorded the time taken for each piece of agar to become completely red.

The stop-clocks from step 6 are shown in Fig. 1.2.

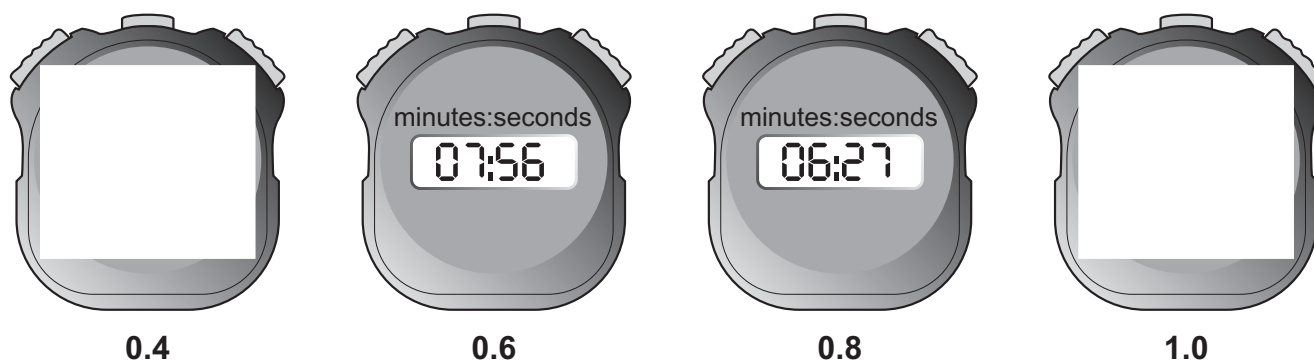


Fig. 1.2

(a) (i) Prepare a table to record the results of the investigation.

Convert the times on the stop-clocks shown in Fig. 1.2 to seconds and record these times in your table.

(ii) State a conclusion for the results.

[1]

(iii) State the independent and dependent variables in this investigation.

independent variable

dependent variable

[2]

(iv) Suggest **two** improvements to the method used for this investigation.

1

2

[2]

(v) Identify **two** hazards in this investigation.

[1]

(b) Plan an investigation to determine the effect of temperature on osmosis in potato plant tissue.

[6]

[Total: 16]

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

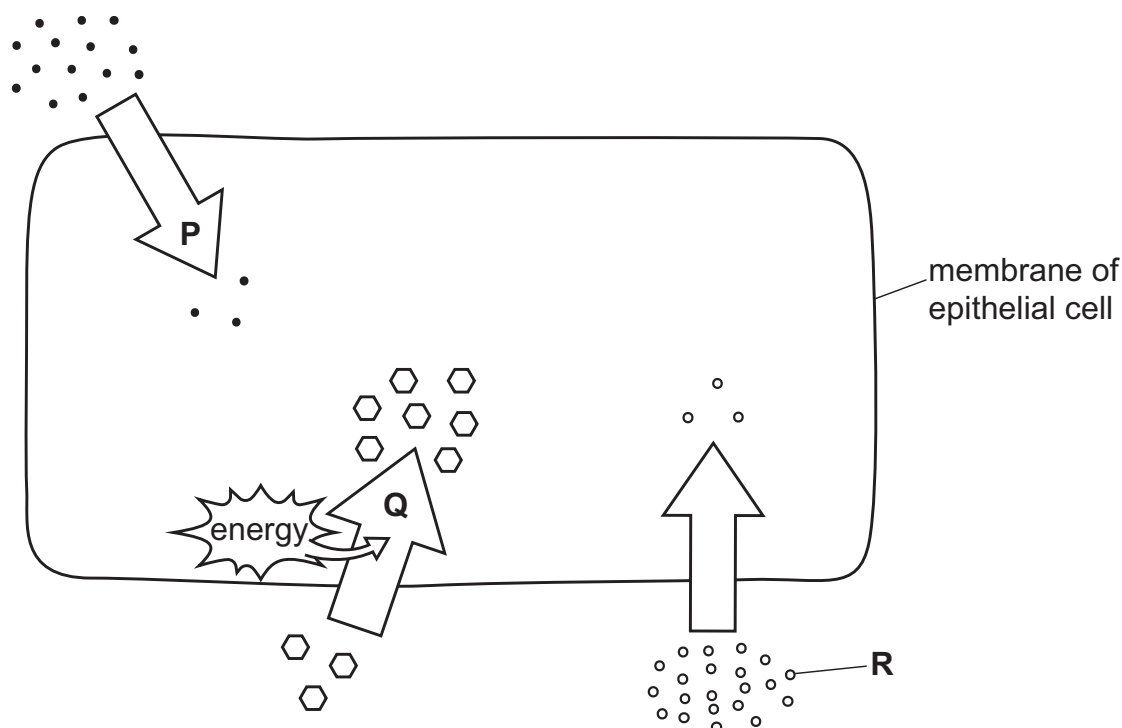


Fig. 1.1

- (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]

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

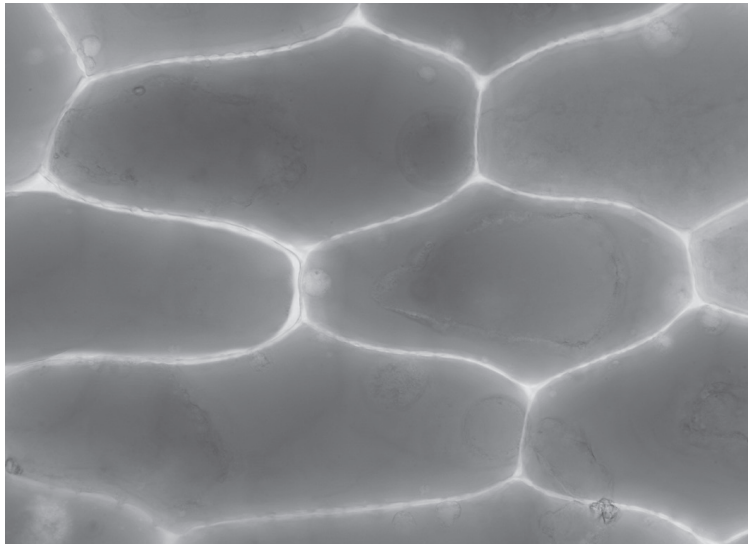


Fig. 1.2

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

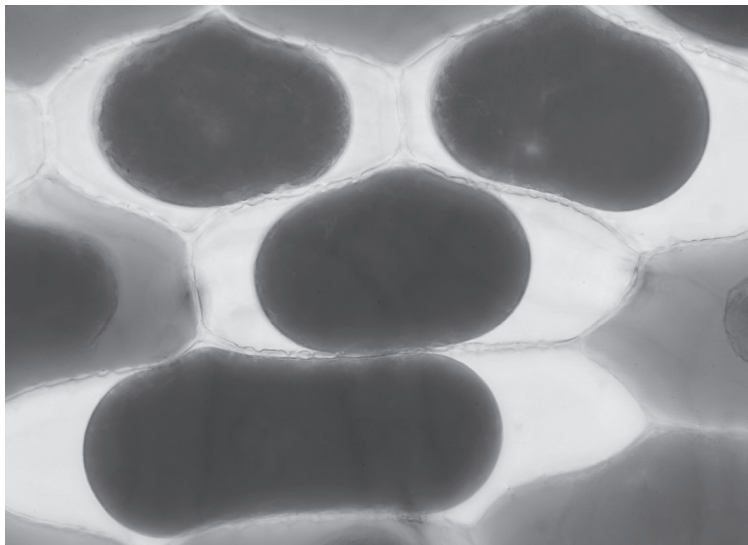


Fig. 1.3

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.

[6]

[Total: 16]

3.2 Osmosis

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS solution 溶液 • osmosis 渗透 • water potential 水势 • turgid 膨胀 • flaccid 松软

Objective

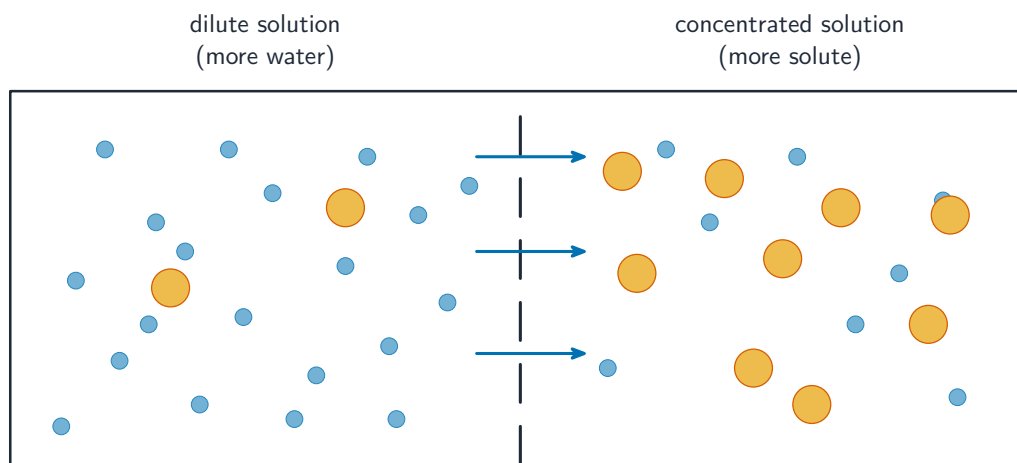
Build the skills to answer exam questions on **osmosis** 渗透 — the definition, **water potential** 水势, and the effect on plant cells (**turgid** 膨胀, **flaccid** 松软, **plasmolysed** 质壁分离).

You must be able to:

- define osmosis (net water movement across a partially permeable membrane)
- describe what happens to plant cells in dilute and concentrated solutions
- interpret a potato/dialysis-tubing experiment

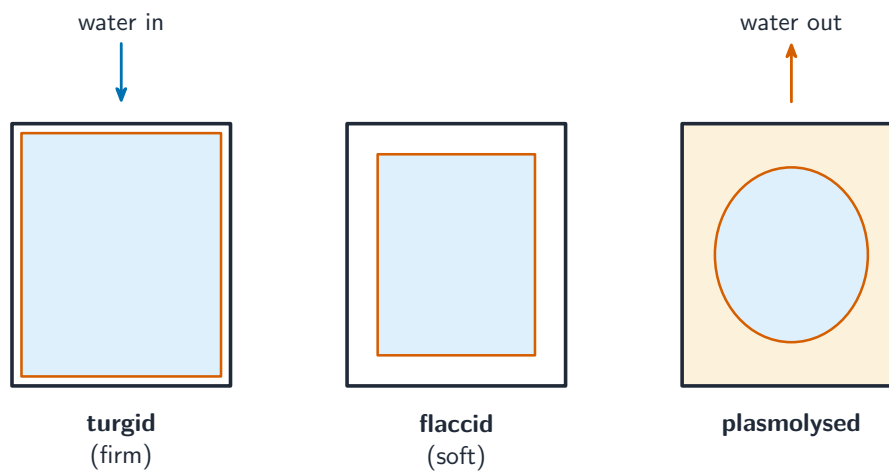
1 Worked examples

■ Osmosis and plant cells



water moves by osmosis to the concentrated side; solute is too big to cross

Osmosis: net movement of water from higher to lower water potential, through a partially permeable membrane



Dilute solution → water in → turgid; concentrated → water out → flaccid/plasmolysed

- potato in water → gains mass; in concentrated solution → loses mass.

2 Practice

2.1 Define osmosis.

[2]

2.2 State what happens to a plant cell placed in pure water.

[1]

3 Exam-style questions

3.1 A plant cell in a concentrated sugar solution becomes: [1]

- **A** turgid
 - **B** flaccid (loses water)
 - **C** larger
 - **D** unchanged
-

3.2 Potato cylinders are placed in different sugar solutions and their mass measured.

(a) State what happens to the mass of a cylinder in pure water, and why. [2]

(b) State what you would observe for a cylinder in a very concentrated solution. [1]

3.3 Explain why turgid cells help support a plant. [2]

Solutions

2.1 the net movement of water molecules from a region of higher water potential to a region of lower water potential, through a partially permeable membrane.

2.2 water moves in by osmosis and the cell becomes turgid (firm).

3.1 B. In a concentrated solution water leaves the cell, so it becomes flaccid.

3.2 (a) the mass increases; because water moves into the cells by osmosis.

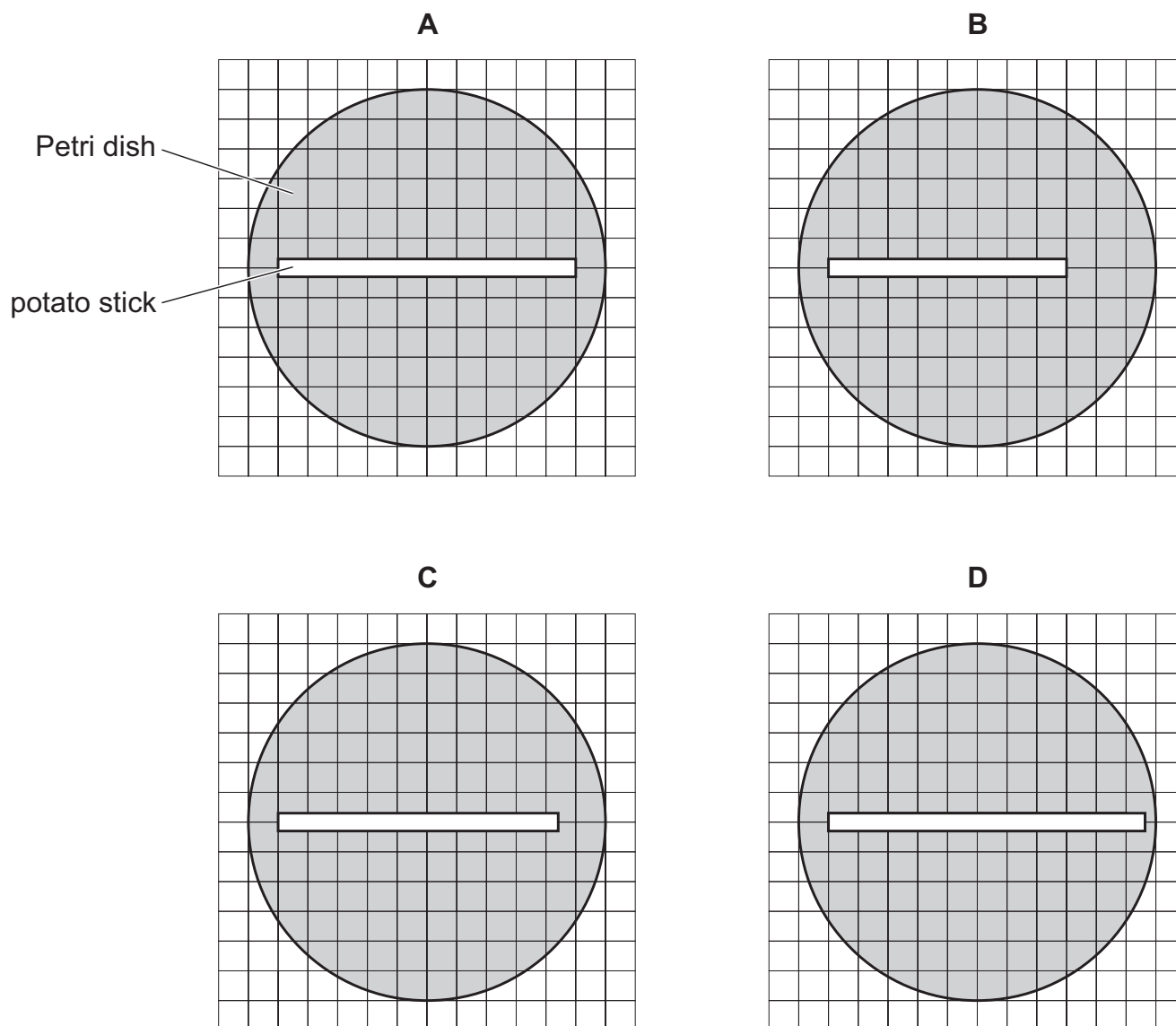
(b) it loses mass / becomes shorter and floppy.

3.3 water inside makes the cells turgid and press out on the cell walls; this firmness holds the plant up straight.

- 5** A potato was used as a source of plant tissue. Four potato sticks of identical size were cut from the same potato. At the start of the investigation, each potato stick was 10 squares long. The potato sticks were put into four separate Petri dishes. Each Petri dish contained a different concentration of sugar solution.

The diagram shows the four Petri dishes after 24 hours.

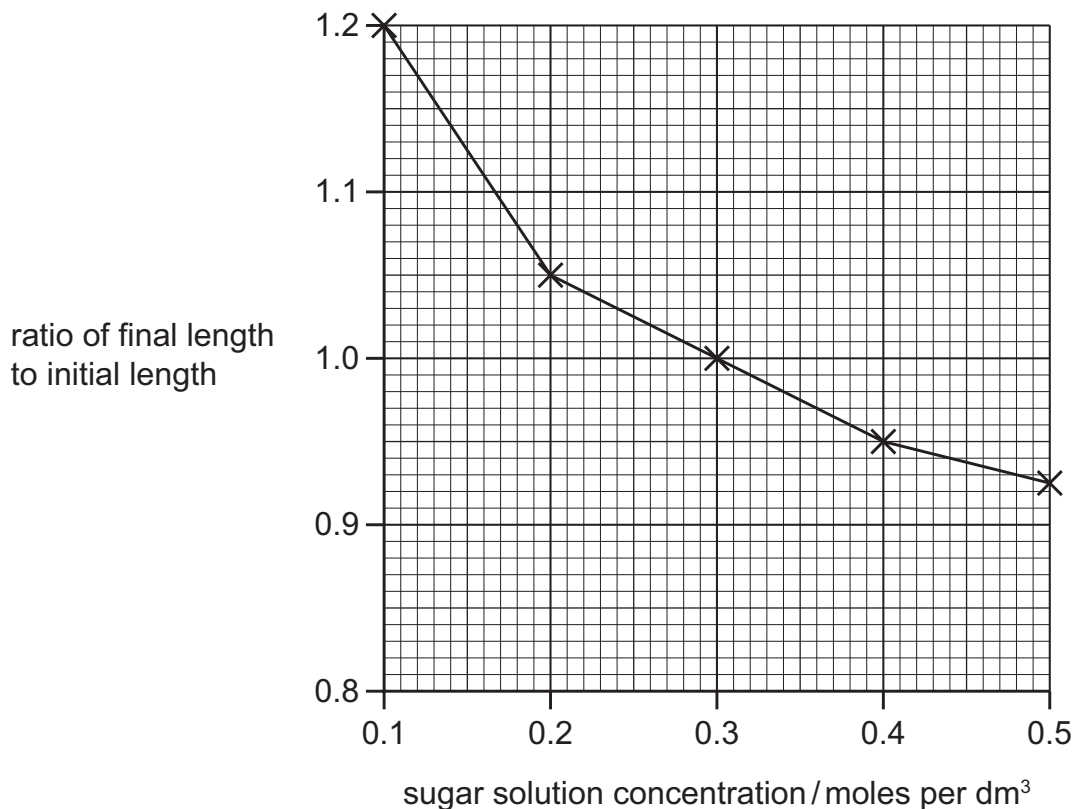
Which dish contains a sugar solution that has a higher water potential than the potato tissue?



- 6** Cylinders of potato tissue were placed in sugar solutions of different concentrations and left overnight.

The lengths of the potato cylinders were measured before and after they were placed in the sugar solutions.

The graph shows the results of the investigation.



In which sugar solution concentrations did the potato cells gain water?

- A** 0.1 moles per dm³ and 0.2 moles per dm³
B 0.1 moles per dm³ only
C 0.2 moles per dm³ and 0.3 moles per dm³
D 0.4 moles per dm³ and 0.5 moles per dm³

- 7** Uncooked potato cylinders of identical size were placed in four different liquids for two hours.

The different liquids are listed.

- 1 pure water
- 2 a sugar solution that was less concentrated than the contents of the potato cells
- 3 a sugar solution that was more concentrated than the contents of the potato cells
- 4 a sugar solution that was the same concentration as the contents of the potato cells

In which liquids will the potato cylinders increase in length?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

- 3** What happens when plant cells are placed in a sugar solution that has a lower water potential than the cytoplasm of the cells?

- A** The cells gain water and become flaccid.
B The cells gain water and become turgid.
C The cells lose water and become flaccid.
D The cells lose water and become turgid.

- 7** A potato was removed from a potato plant. A 5 g cube of potato was cut and put into a beaker of distilled water.

What is the most likely mass of the cube of potato after two hours?

- A** 2 g **B** 4 g **C** 5 g **D** 7 g

5 Fig. 5.1 is a diagram of a plant root hair cell.

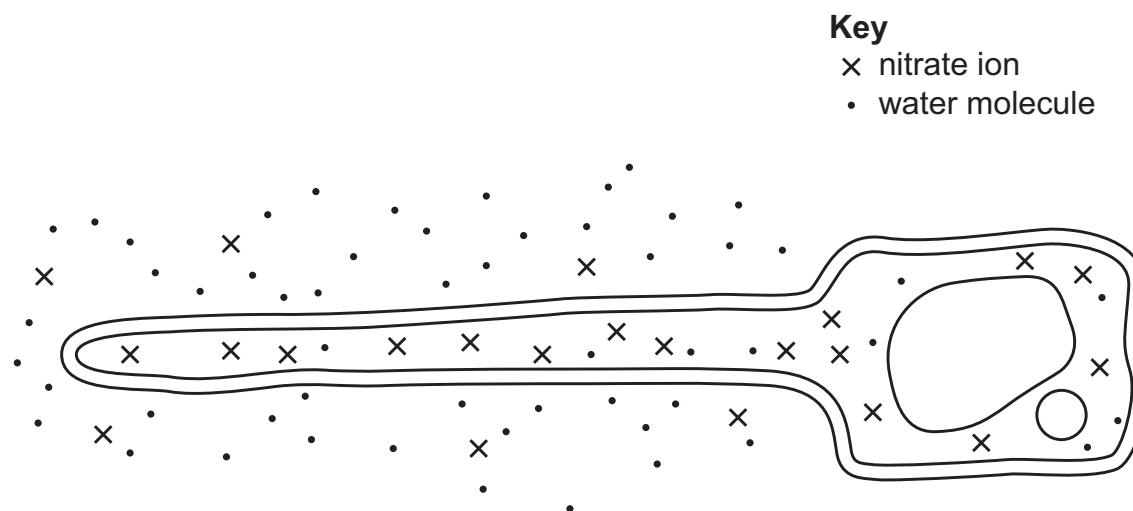


Fig. 5.1

- (a) (i) Using the information in Fig. 5.1, explain how nitrate ions are transported into the root hair cell.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) State **two** ways that nitrogen fixation occurs.

1

2 [1]

- (b) State the name of the process that moves water molecules into root hair cells.

..... [1]

(c) Describe differences **and** similarities between the structure of a plant root hair cell and a bacterial cell.

[5]

[Total: 11]

- 1
- A student investigated the effect of the concentration of salt solutions on osmosis in potato tissue.

The student used three different concentrations of salt solution and potato tissue that had been cut into cylinders.

(a) (i) Using the information in Table 1.1, decide the volumes of **S** and **W** needed to make 50 cm³ of a 0.5 mol per dm³ salt solution.

Complete Table 1.1 by writing in the volumes of **S** and **W** needed to make the 0.5 mol per dm³ salt solution.

Table 1.1

beaker	volume of 1.0 mol per dm ³ salt solution S /cm ³	volume of distilled water W /cm ³	final concentration of salt solution /mol per dm ³
S1	50	0	1.0
S2			0.5
S3	0	50	0.0

[1]

The student used this method:

- Step 1
- Label three beakers **S1**, **S2** and **S3**.
- Step 2
- Use the volumes of 1.0 mol per dm³ salt solution **S** and distilled water **W** shown in Table 1.1 to make the salt solutions in beakers **S1**, **S2** and **S3**.
- Step 3
- Put the potato cylinders onto a white tile and cut each potato cylinder into 3 mm discs, as shown in Fig. 1.1. You will need 30 potato discs.

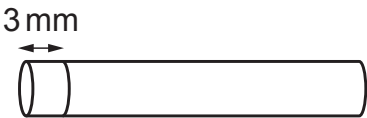


Fig. 1.1

- Step 4
- Place 10 potato discs in a line next to a ruler, as shown in Fig. 1.2.

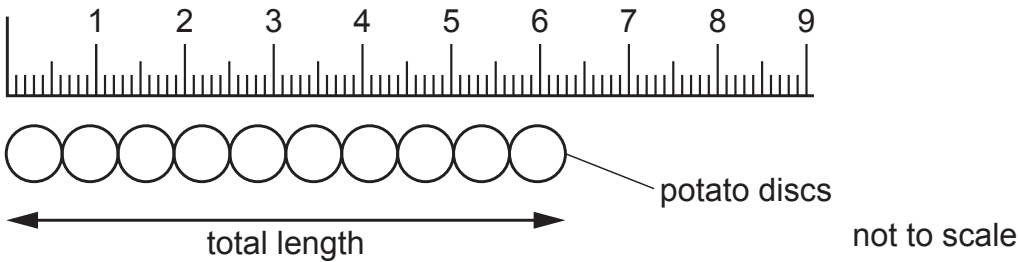


Fig. 1.2

- Step 5
- Measure the total length of the 10 potato discs.
- Step 6
- Put the 10 potato discs into beaker **S1**.

- Step 7 Repeat step 4 to step 6 with the other potato discs and the salt solutions in beakers **S2** and **S3**.
- Step 8 Start the stop-clock and leave the potato discs in the beakers of salt solution for 20 minutes.
- Step 9 Remove the 10 potato discs from beaker **S1** and put them onto the white tile, line them up along the ruler, as shown in Fig. 1.2.
- Step 10 Measure the final total length of the 10 potato discs.
- Step 11 Repeat step 9 and step 10 with the potato discs in beaker **S2** and beaker **S3**.

Fig. 1.3 shows the notes the student recorded about the results.

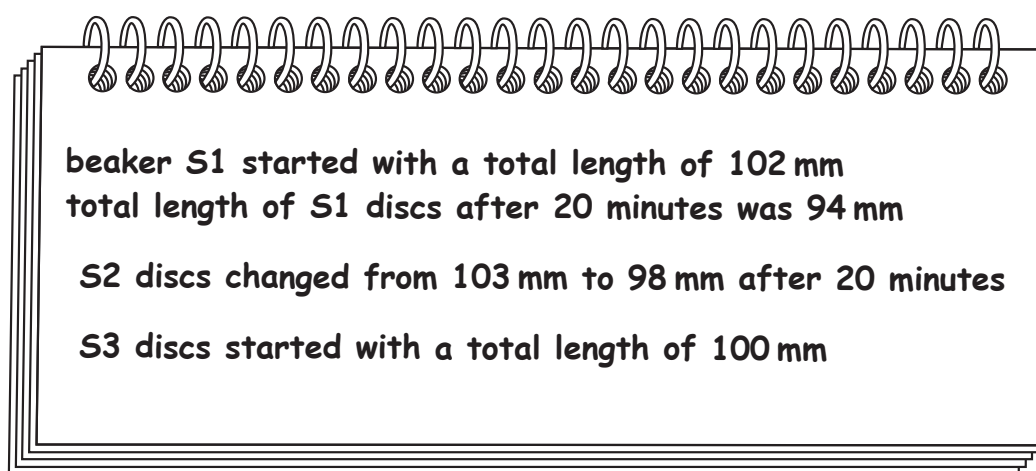


Fig. 1.3

Fig. 1.4 is a diagram showing the actual size of the 10 potato discs from beaker **S3** after 20 minutes.



Fig. 1.4

- (ii) Measure the total length of the 10 potato discs in Fig. 1.4.

S3 total length mm [1]

(iii) Prepare a table and record the results shown in Fig. 1.3 and your measurement in 1(a)(ii).

Include the final concentrations of the salt solutions in your table.

[3]

(iv) Calculate the **change** in total length of the 10 potato discs in each beaker.

beaker **S1** mm

beaker **S2** mm

beaker **S3** mm

[1]

(v) State a conclusion for the results of this investigation.

.....
.....
..... [1]

(vi) State the dependent variable in this investigation.

..... [1]

(vii) Suggest why the student used 10 potato discs instead of 1 potato disc in each salt solution.

.....

.....

..... [1]

(viii) Describe **one** safety precaution the student should take when preparing the potato discs.

.....

..... [1]

(b) The student added a few drops of a yellow-brown solution to test one of the potato discs.

The solution changed to a blue-black colour.

Identify the solution added and state a conclusion for this test.

solution

conclusion [1]

(c) Fig. 1.5 shows a leaf from a potato plant.

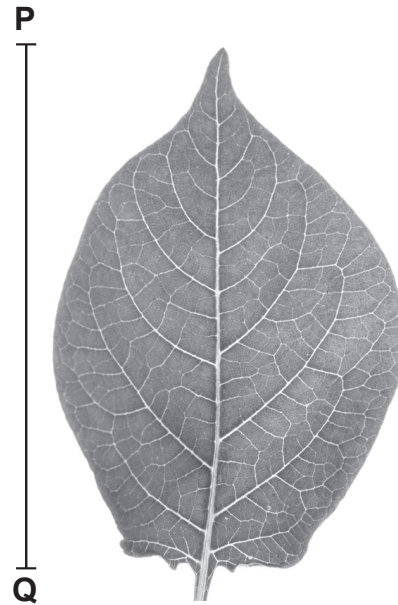


Fig. 1.5

(i) Draw a large diagram of the leaf shown in Fig. 1.5.

- (ii) Line **PQ** represents the length of the leaf in Fig. 1.5.

Measure the length of line **PQ** in Fig. 1.5.

length of line **PQ** mm

The actual length of the leaf is 39 mm.

Using your measurement and the formula, calculate the magnification of the leaf in Fig. 1.5.

$$\text{magnification} = \frac{\text{length of line PQ in Fig. 1.5}}{\text{actual length of the leaf}}$$

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

Space for working.

.....
[3]

- (iii) Fig. 1.6 shows a leaf from a tomato plant. The tomato leaf is narrower than the potato leaf shown in Fig. 1.5.



Fig. 1.6

Compare the leaves shown in Fig. 1.5 and in Fig. 1.6.

Describe **one** visible difference, other than size, and **one** visible similarity.

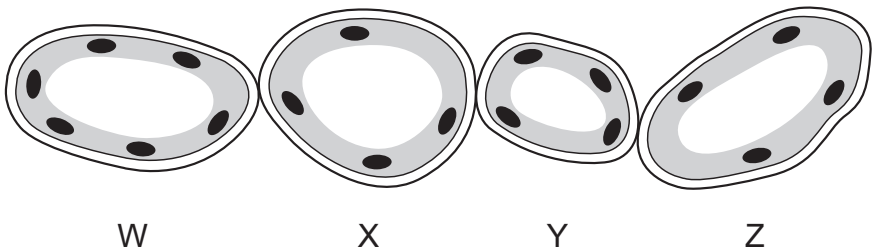
difference

.....

similarity

.....

5 The diagram shows four mesophyll cells, W, X, Y and Z. Water moves through these cells.



Which arrow shows the direction of movement of water through these cells?

	direction of water movement	water potential/kPa			
		W	X	Y	Z
A	→	−600	−450	−350	−250
B	→	−350	−400	−450	−600
C	←	−400	−450	−500	−550
D	←	−200	−300	−350	−450

3.3 Active transport

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS active transport 主动运输 • root hairs 根毛 • carrier proteins 载体蛋白 • energy 能量
• transport 运输

Objective

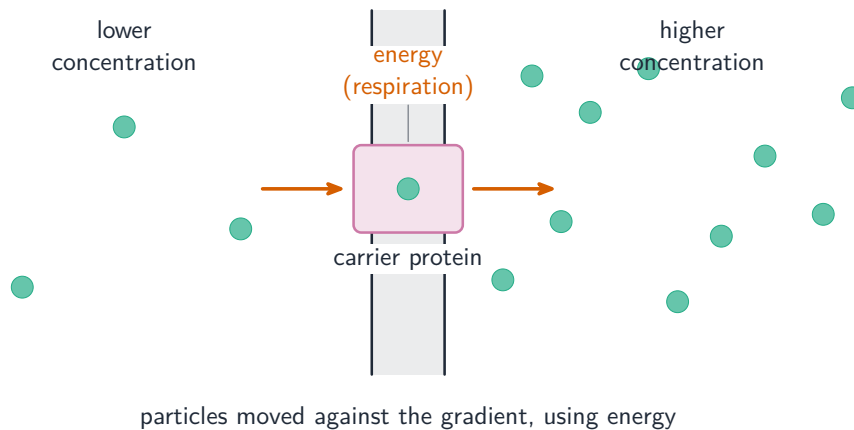
Build the skills to answer exam questions on **active transport** 主动运输 — the definition, why it needs energy, and the role of **carrier proteins** 载体蛋白.

You must be able to:

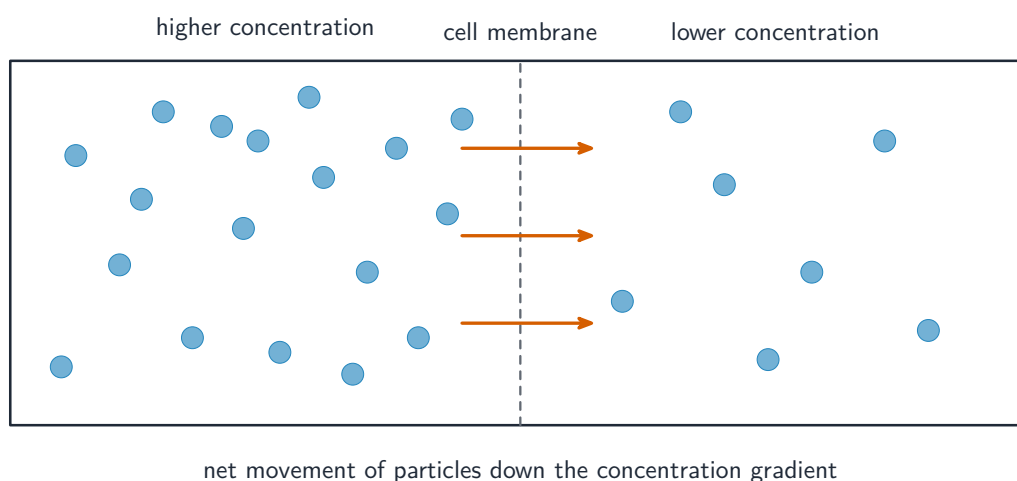
- define active transport (movement against the gradient, using energy)
- explain why it needs energy from respiration
- give an example (root hairs taking up mineral ions)

1 Worked examples

■ Active transport



Active transport: against the gradient, using energy from respiration and a carrier protein



Active transport contrasts with passive diffusion

Process	Direction	Energy?
diffusion	high $\rightarrow$ low	no
osmosis	high $\rightarrow$ low water potential	no
active transport	low $\rightarrow$ high (against)	yes

2 Practice

2.1 Define active transport.

[2]

2.2 State the source of energy for active transport.

[1]

3 Exam-style questions

3.1 Which process moves particles **against** the concentration gradient?

[1]

- A diffusion
- B osmosis
- C active transport
- D evaporation

3.2 Root hair cells take up mineral ions from the soil.

(a) Name the process used when the ions are more concentrated inside the cell. [1]

(b) Explain why this process needs energy. [2]

3.3 Explain the role of carrier proteins in active transport. [2]

Solutions

2.1 the movement of particles through a membrane from a lower to a higher concentration (against the gradient), using energy from respiration.

2.2 respiration.

3.1 C. Active transport moves particles against the gradient.

3.2 (a) active transport.

(b) the ions move against the concentration gradient (uphill), which requires energy.

3.3 carrier proteins in the membrane pick up the ions/molecules and carry them across the membrane using energy.

6 Which row shows correct statements about active transport?

	direction of movement	requires a partially permeable membrane
A	down a concentration gradient	no
B	down a concentration gradient	yes
C	against a concentration gradient	no
D	against a concentration gradient	yes

18 Which process requires energy from respiration?

- A** diffusion
- B** osmosis
- C** protein synthesis
- D** transpiration

4 A student made the following statements about the movement of ions by active transport.

- 1 It is the net movement of particles from a low concentration to a high concentration.
- 2 It is the net movement of particles from a high concentration to a low concentration.
- 3 It requires the use of energy from respiration.
- 4 It can only take place in living cells.

Which statements are correct?

- A** 1, 3 and 4 **B** 1 and 4 only **C** 2 and 4 **D** 2 only

19 Which process in plants uses energy from respiration?

- A** cell division
- B** osmosis
- C** photosynthesis
- D** transpiration

6 Three processes are listed.

- 1 Molecules or ions are moved across membranes.
- 2 Molecules or ions are moved by protein carriers.
- 3 Ions are taken up by root hairs.

Which processes can involve active transport?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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

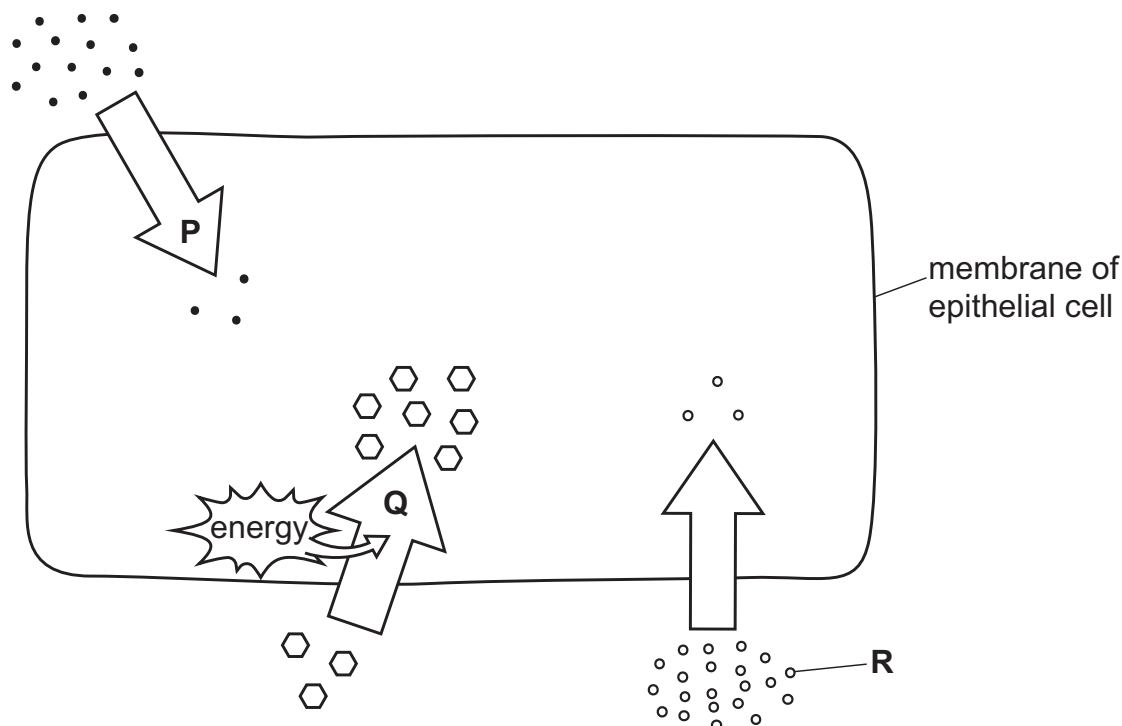


Fig. 1.1

- (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]

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

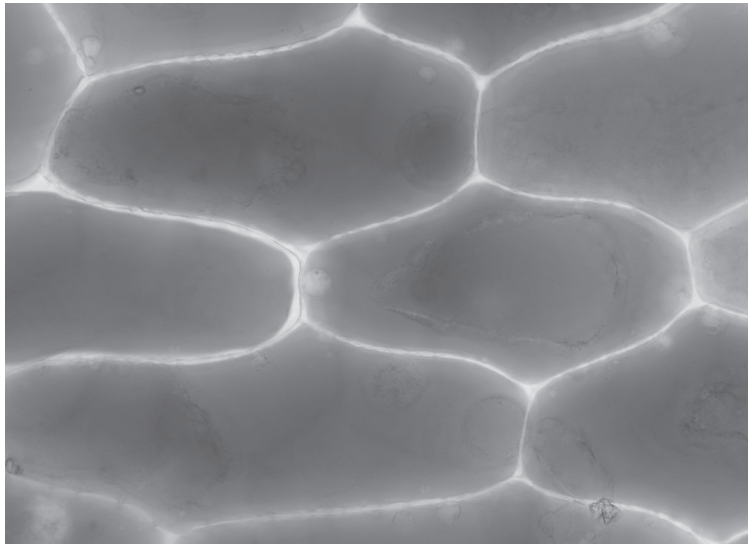


Fig. 1.2

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

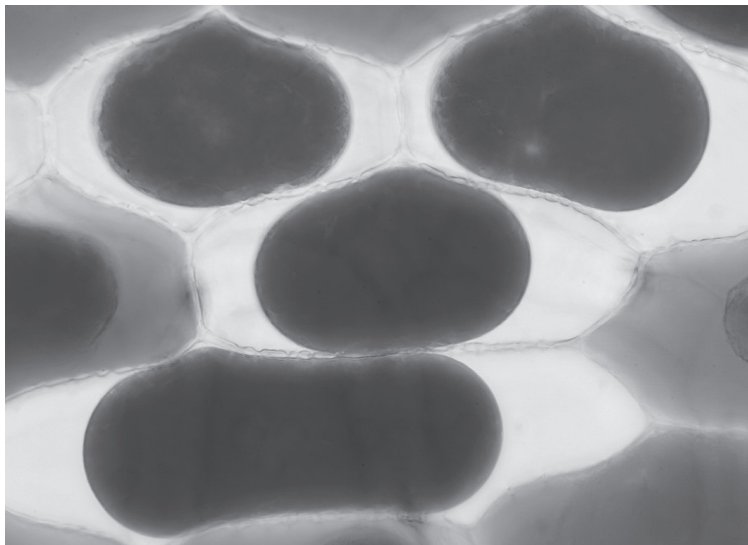


Fig. 1.3

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.

[6]

[Total: 16]