

APOLLO

Water potential

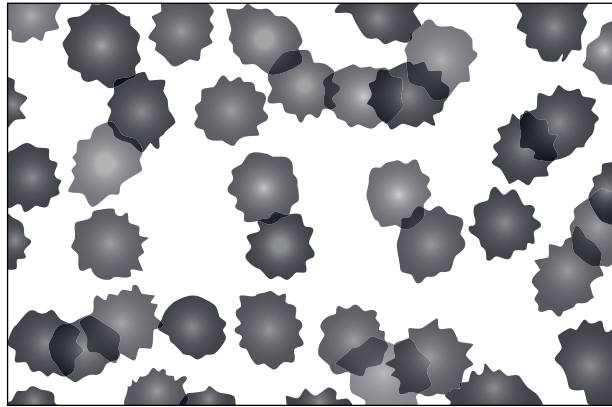
HL

Biology

First assessment 2025

6 questions | questions

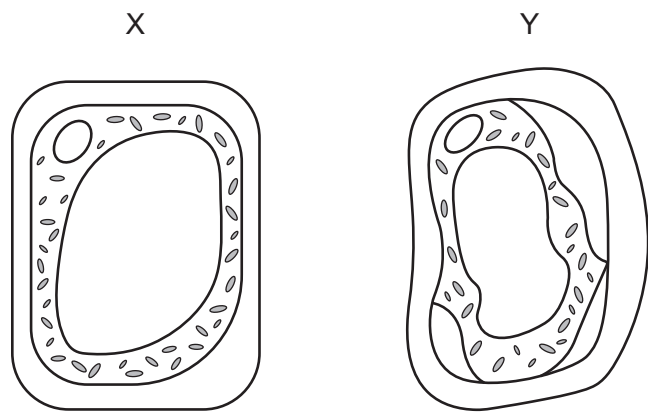
- 20.** The image shows human blood cells immersed in a solution.



What can be deduced from the image?

- A. The solution is hypotonic as the cells are crenated.
- B. The solution is hypotonic as the cells are turgid.
- C. The solution is hypertonic as the cells are crenated.
- D. The solution is hypertonic as the cells are turgid.

20. Two plant cells are shown as they appear in different solutions X and Y.



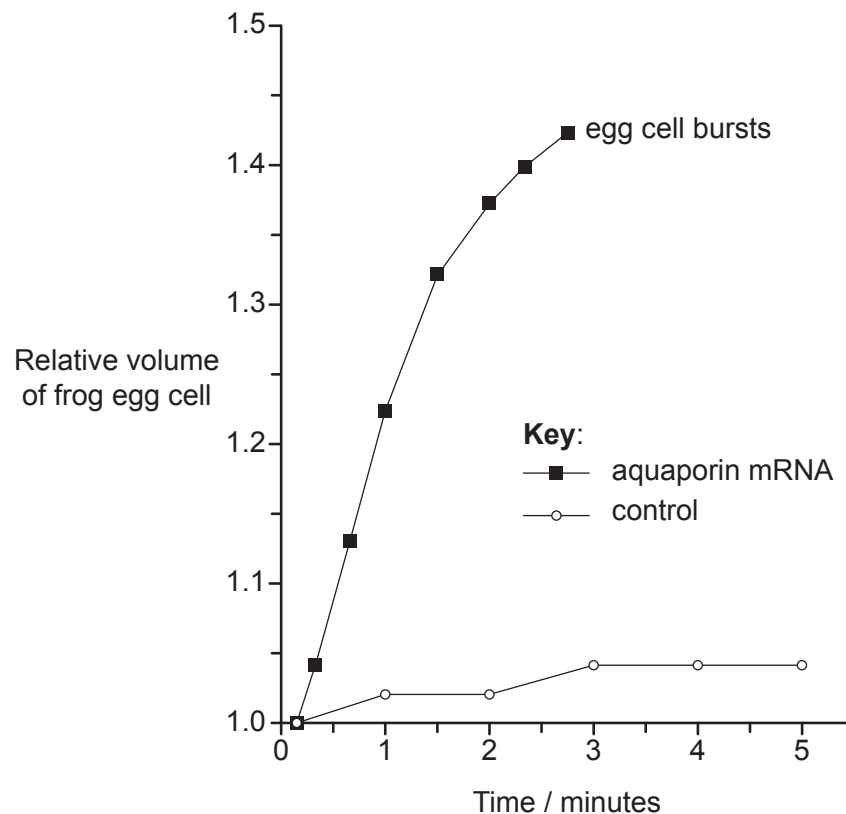
What happens to water and pressure potential inside the cell if it is moved from solution X to solution Y?

	Water potential	Pressure potential
A.	does not change	decreases
B.	decreases	decreases
C.	does not change	increases
D.	increases	increases

2. In the early 1990s, investigations involving egg cells from the African clawed frog (*Xenopus laevis*) led to the discovery of membrane channel proteins called aquaporins.

In one investigation, scientists injected 10 frog egg cells with a solution containing mRNA encoding for an aquaporin, and another 10 frog egg cells with distilled water (control cells). All the frog egg cells were then incubated in a hypotonic solution. The volume of the frog egg cells was then measured during a period of five minutes.

The graph shows the mean results of the investigation.



- (a) State the direction of net movement of water across the plasma membrane of all the frog egg cells between 0 and 3 minutes.

[1]

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(Question 2 continued)

- (b) (i) Explain the reasons for the different results obtained for the frog egg cells with aquaporin mRNA and the control frog egg cells. [2]

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- (ii) Discuss the role of aquaporins in the collecting ducts of a human kidney when the water content of blood is too low. [3]

[illegible]

- (c) Outline the reason that the results are displayed as mean relative volumes rather than mean volumes. [1]

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- (d) Comment on the reliability of the results of this investigation. [1]

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(Question 2 continued)

- (e) In investigations of this type, scientists usually find that there is a short time delay between the introduction of mRNA into a cell and the effect on the cell.
Explain this observation.

[2]



Turn over

- 20.** The water potential of a plant cell is -0.24 kPa. If the pressure potential of the cell is 0.46 kPa, what is the solute potential of that cell?

$$\Psi_w = \Psi_s + \Psi_p$$

- A. 0.22 kPa
- B. -0.22 kPa
- C. 0.70 kPa
- D. -0.70 kPa

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

4. (a) Explain how the pressure potential and solute potential change inside a plant root cell when it is placed into a solution that is more hypotonic than the cell's cytoplasm. [3]

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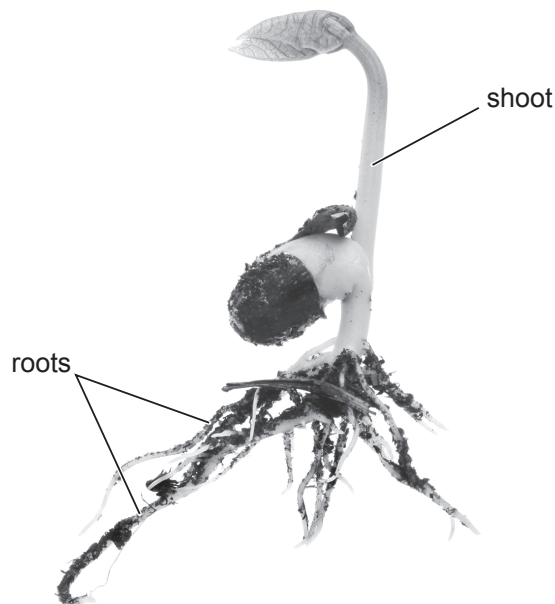
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- (b) The photograph shows a seedling (young plant) of the family Fabaceae. The shoot and roots have been labelled.



- (i) Explain how root pressure is generated to cause movement of water through seedlings. [2]

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(Question 4 continued)

(ii) State the name and site of production of **two** phytohormones that regulate the growth of seedlings. [2]

Name of phytohormone	Site of production



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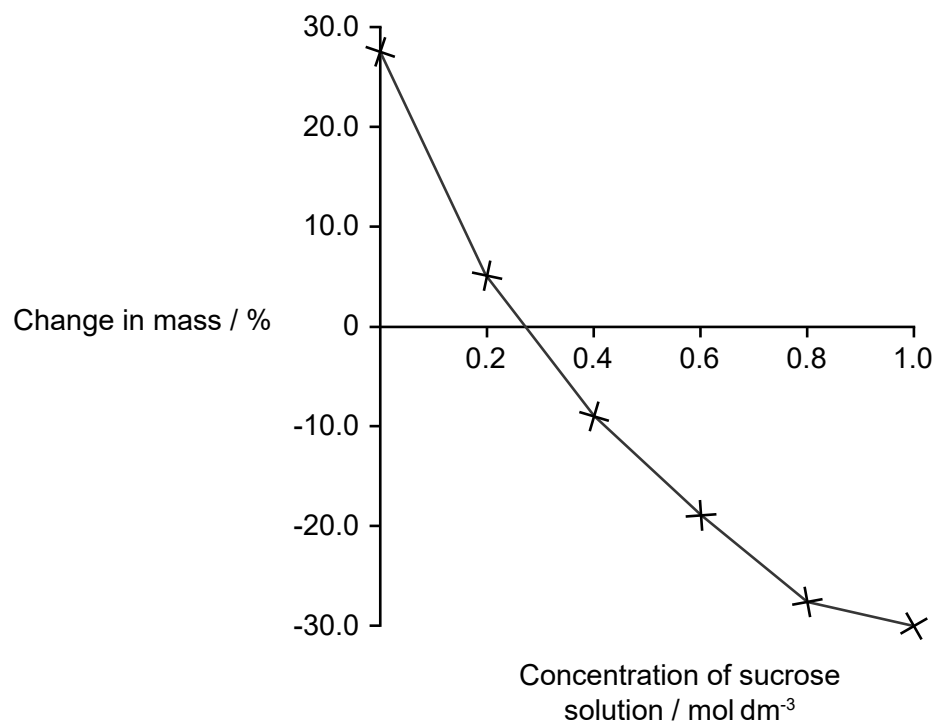
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1. Beetroot (*Beta vulgaris*) tissue was cut into pieces of similar size and shape. The masses of the individual pieces were measured. Three pieces of beetroot were placed in each of six sucrose solutions of different concentrations.

After three hours, the pieces of beetroot were removed from the solutions, surface dried and their masses recorded. The mean percentage change in mass of the beetroot in each solution was calculated and displayed in the graph.



Concentration of sucrose solution / mol dm ⁻³	Change in mass / %
0.0	28.0
0.2	5.0
0.4	-9.0
0.6	-19.0
0.8	-28.0
1.0	-30.0

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(Question 1 continued)

(a) (i) State the independent variable in this experiment. [1]

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(ii) Outline the reason that beetroot pieces of similar size and shape are needed in order to obtain reliable results. [2]

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(b) Suggest a reason for expressing the changes in mass as percentages. [1]

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(c) Explain the effect of the 0.0 mol dm⁻³ sucrose solution on the water potential of the beetroot pieces. [3]

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