

# Osmosis Investigation

Answer the questions below.

1. Define osmosis.

**The movement of water molecules from a dilute solution to a concentrated solution through a partially permeable membrane.**

2. Name the type of membrane required for osmosis to take place.

**A partially permeable membrane**

3. Describe the difference between a hypertonic and a hypotonic solution.

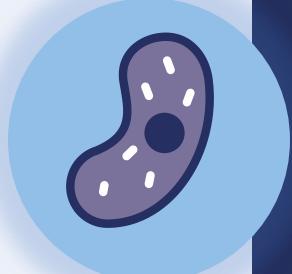
**A hypertonic solution has a higher solute concentration than a cell/sample and a hypotonic solution has a lower solute concentration than a cell/sample.**

4. State the SI unit of mass.

**Kilograms (kg)**

5. Describe the difference between mass and weight.

**Mass is the amount of matter in an object and weight is the effect of gravity on the mass.**



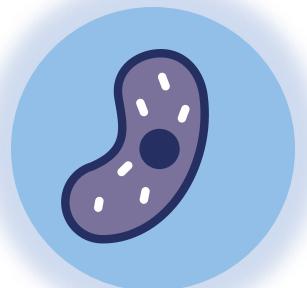
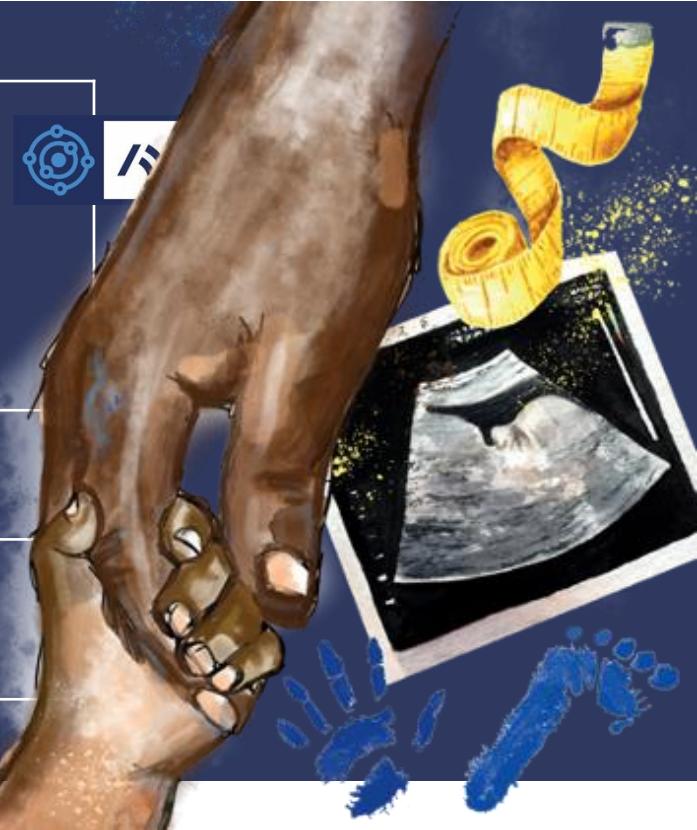
# Osmosis Investigation

B3.1.10

Science  
**Mastery**

- B3.1.1 Prior Knowledge Review
- B3.1.2 Eukaryotic and Prokaryotic Cells
- B3.1.3 Aseptic Technique
- B3.1.4 Growth of Bacteria
- B3.1.5 Microscopes
- B3.1.6 Observing Cells
- B3.1.7 Diffusion

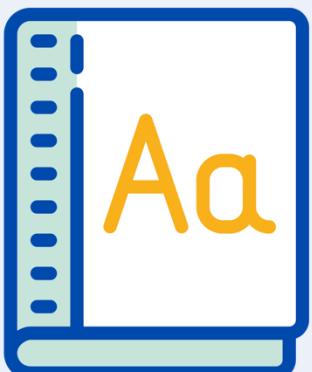
- B3.1.8 Diffusion in Living Things
- B3.1.9 Osmosis
- **B3.1.10 Osmosis Investigation**
- B3.1.11 Active Transport
- B3.1.12 Cell Division
- B3.1.13 Cancer
- B3.1.14 Stem Cells



## Following this lesson, students will be able to:

- State the independent, dependent and control variables of the investigation
- Describe the movement of water by osmosis when a potato is placed in different solutions
- Explain how to determine the starting concentration of the potato

### Key Words:



osmosis

dilute

concentrated

variables

hypotonic

hypertonic

# This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach, explanation, demonstration or modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.

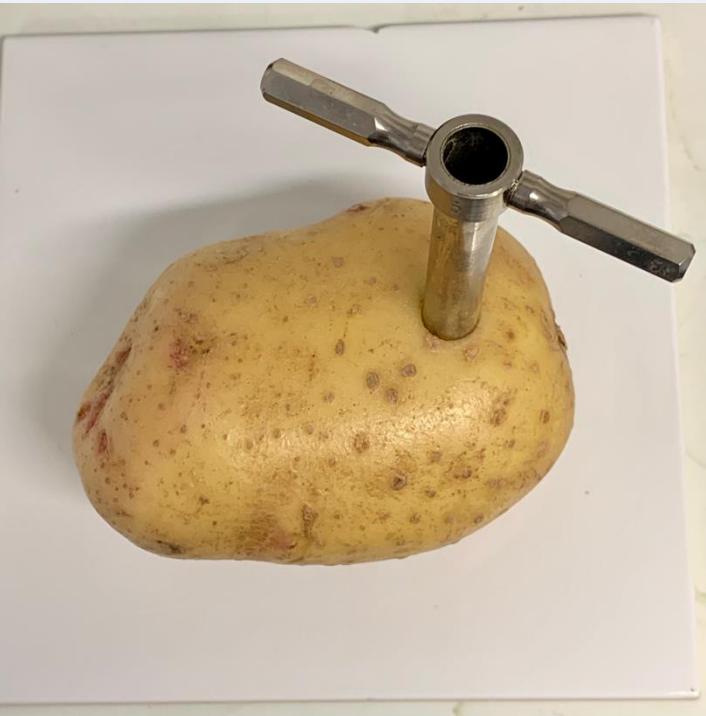
## Exit ticket

1. Which best states the definition of osmosis?  
 A. Water going out of cells into salty water.  
 B. The diffusion of water molecules from a dilute solution to a concentrated solution.  
 C. The movement of molecules from a high concentration to a low concentration
2. Which scenario would result in a plasmolysed cell?  
 A. A plant cell being placed in a hypertonic solution  
 B. An animal cell being placed in a hypertonic solution  
 C. A plant cell being placed in a hypotonic solution
3. A hypotonic solution is...  
 A. A solution that has a higher concentration than the cell/sample  
 B. A solution that has the same concentration as the cell  
 C. A solution that has a lower concentration than the cell/sample

# Osmosis Practical

We can use the idea of osmosis to look at **relative** concentrations of solutes within plant cells

What would happen to pieces of potato if they were put into **hypotonic** or **hypertonic** solutions?



**We will be investigating the effect of changing concentrations of salt solutions on the mass of potato tissue.  
Is this correct?**

In this investigation, the dependent variable is the concentration of salt solutions.

## Which statements do you agree with?

I think that the potato placed in an isotonic solution will have the same mass at the end

I think that the potato placed in a concentrated solution will increase in mass

I think that the potato placed in a hypertonic solution will increase in mass

I think that the potato placed in a dilute solution will decrease in mass

# Osmosis Practical

## Calculating percentage change in mass

If the final number is bigger than the initial number you are calculating a **percentage increase**

Increase = Final number – Initial Number

$$\% \text{ Increase} = \frac{\text{Increase}}{\text{Initial number}} \times 100$$

Example question:

**Potato A had an initial mass of 5g and now has a mass of 7.5g. Calculate the percentage increase in mass.**

$$\begin{aligned}\text{Increase} &= 7.5 \text{ g} - 5 \text{ g} \\ &= 2.5 \text{ g}\end{aligned}$$

$$\% \text{ Increase} = \frac{2.5}{5} \times 100$$

= 50% increase

# Osmosis Practical

## Calculating percentage change in mass

If the final number is smaller than the initial number you are calculating a **percentage decrease**

Decrease = Initial number – Final number

$$\% \text{ Decrease} = \frac{\text{Decrease}}{\text{Initial number}} \times 100$$

Example question:

**Potato B had an initial mass of 5 g and now has a mass of 4.5 g. Calculate the percentage decrease in mass.**

$$\begin{aligned}\text{Decrease} &= 5 \text{ g} - 4.5 \text{ g} \\ &= 0.5 \text{ g}\end{aligned}$$

$$\begin{aligned}\% \text{ Decrease} &= \frac{0.5}{5} \times 100 \\ &= 10\%\end{aligned}$$

= 10% decrease

## Quick Quiz

Determine whether each statement is true or false:

1. Osmosis involves a fully permeable membrane **False**
2. Osmosis is the movement of water from a dilute concentration to a concentrated solution **True**
3. An independent variable is one which is kept the same during an experiment **False**
4. A dependent variable is one which is measured during an experiment and plotted on the y-axis **True**
5. To make an experiment fair it is important to change as many variables as possible **False**

## Drill

1. We will be investigating the effect of changing concentrations of salt solutions on the mass of potato tissue. State the:
  - a) Independent variable
  - b) Dependent variable
  - c) Two control variables
2. What would happen to the mass of a piece of potato if it was put into a hypotonic solution?
3. What would happen to the mass of a piece of potato if it was put into a hypertonic solution?
4. State the equation used to calculate percentage increase.
5. Name the piece of equipment used to cut cylinders from potato.

## Drill answers

1.

- a) The concentration of salt solution
- b) Change in mass of the potato
- c) Any two of the following: Temperature, volume of the salt solution, initial mass of the potato cylinder, initial length of the potato cylinder, amount of time potato cylinders are left in solution for.

2. *Water from the solution would move via osmosis into the potato so the potato would gain mass*

3. *In a hypertonic solution water would move out of the potato via osmosis so the potato would lose mass.*

4.  $\% \text{ Increase} = \frac{\text{Increase}}{\text{Initial number}} \times 100$

5. Cork borer

# I: Scientific investigation method

Example question:

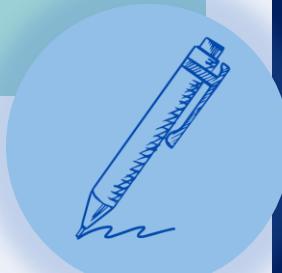
A student investigated the effect of different concentrations of sugar solution on pieces of potato. When the student lifted the potato out of the solution, **explain** why the student dried each piece of potato before weighing it.

Model answer:

- To remove excess water on the outside of the potato
- because otherwise this would increase the mass

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



# We: Scientific investigation method

Example question:

In this investigation, percentage change is calculated.

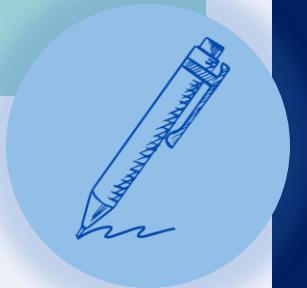
**Explain** why percentage change is calculated.

Model answer:

- plant samples may not have exactly the same mass
- using percentage change means we can compare results between different groups
- this means our results are more reproducible

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



# You: Scientific investigation method

Example question:

**Describe** the change which will occur if a piece of peeled potato is placed in a concentrated sugar solution and **explain** why this change occurs.

Model answer:

- The piece of potato will shrink
- Because the concentration of sugar is greater in the solution than concentration inside the cell
  - (or the concentration of water is higher inside the cell than in the solution)
- So, water moves out of the cell via osmosis

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



## I: Interpreting results

A student investigated the effect of different concentrations of sugar solution on the percentage change in mass of potato pieces.

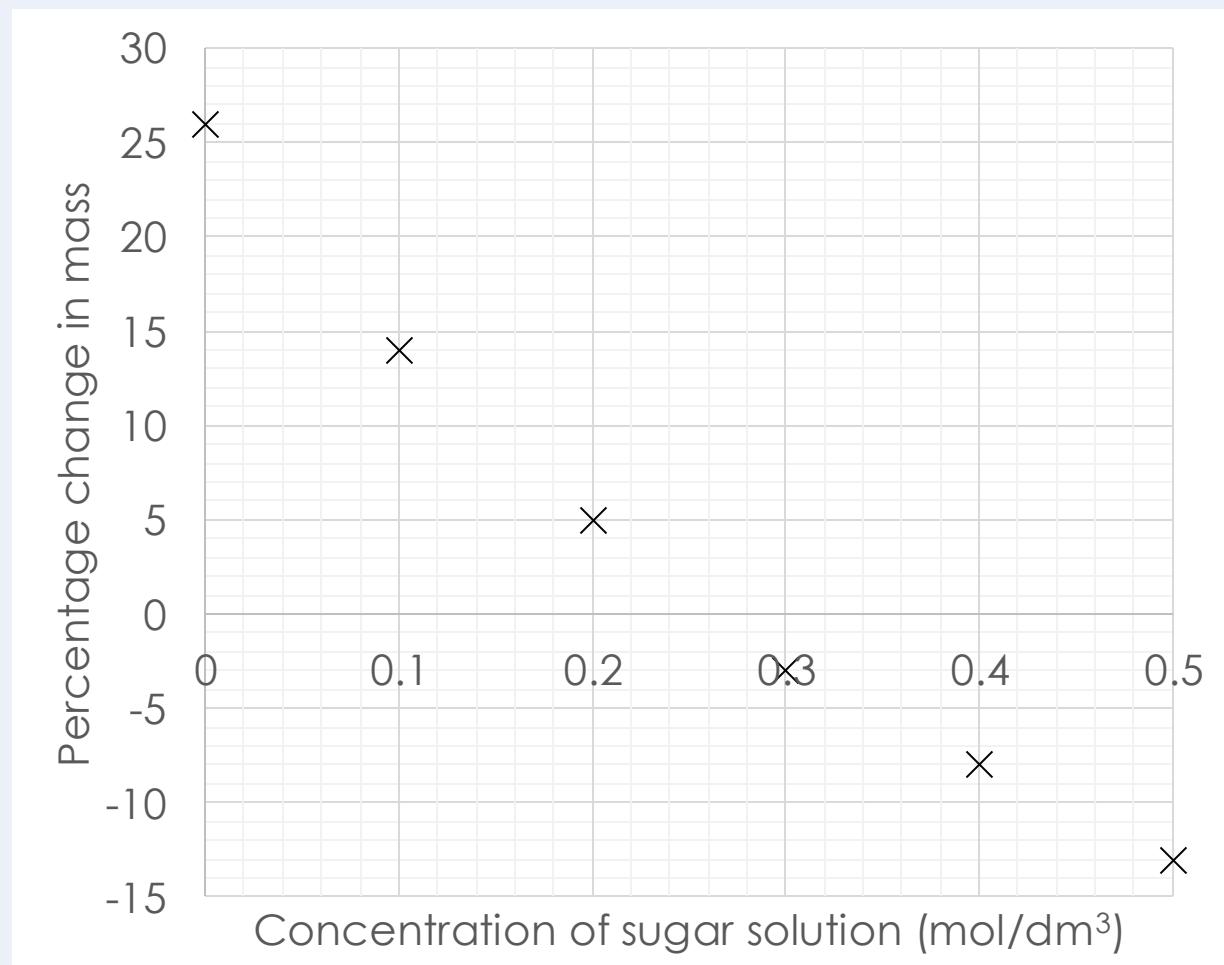
What is the percentage change in mass of potato when placed in 0.1 mol/dm<sup>3</sup> sugar solution?

(+)14%

**Explain** why this would have happened.

Because the concentration of sugar is lower in the solution than concentration inside the potato cells

So, water moves into the cells via osmosis



## We: Interpreting results

A student investigated the effect of different concentrations of sugar solution on the percentage change in mass of potato pieces.

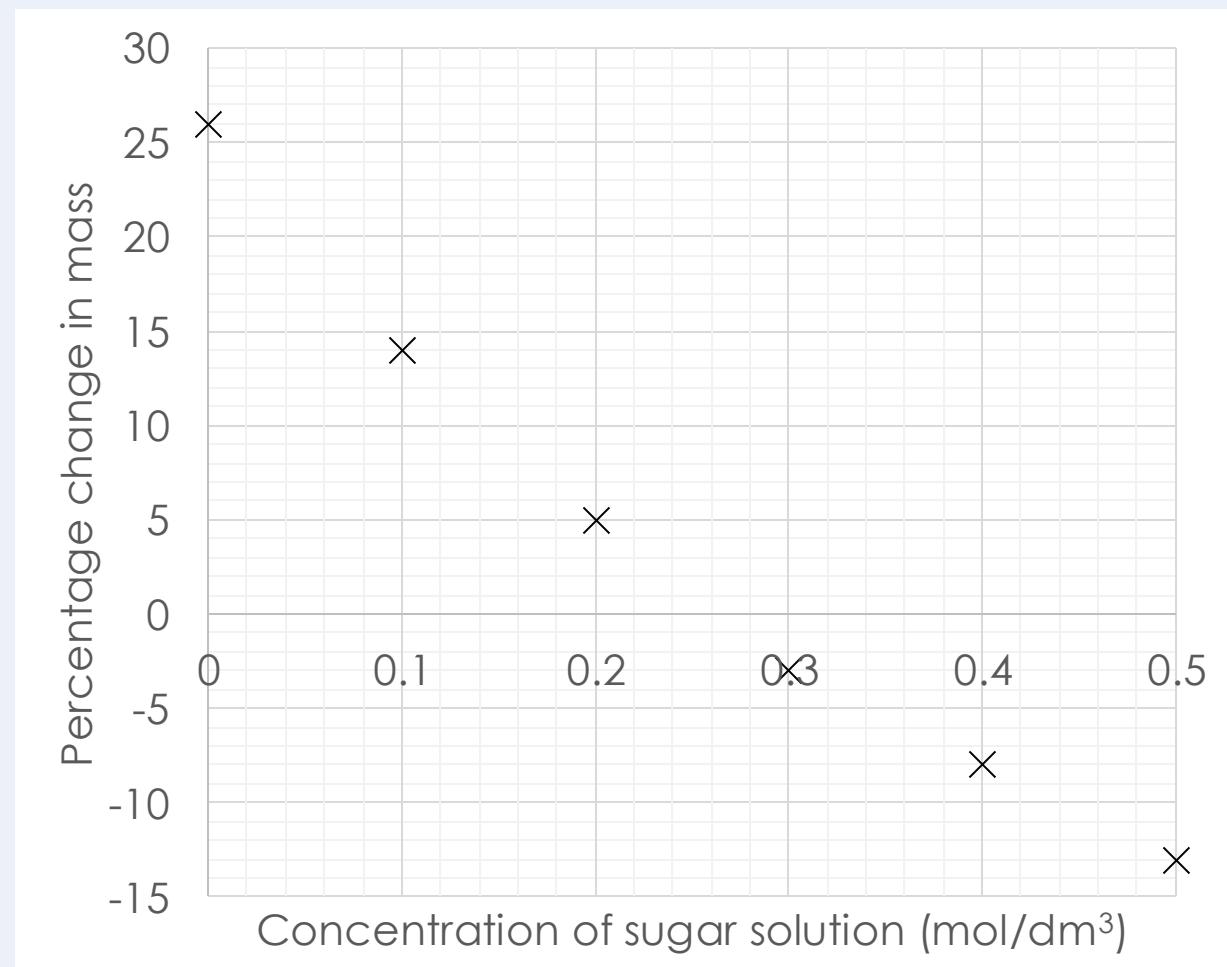
What is the percentage change in mass of potato when placed in 0.4 mol/dm<sup>3</sup> sugar solution?

-8%

**Explain** why this would have happened.

Because the concentration of sugar is greater in the solution than concentration inside the potato cells

So, water moves out of the cells via osmosis



## You: Interpreting results

A student investigated the effect of different concentrations of sugar solution on the percentage change in mass of potato pieces.

Predict what the change in mass of potato would be when placed in a concentration of  $0.25 \text{ mol/dm}^3$ .

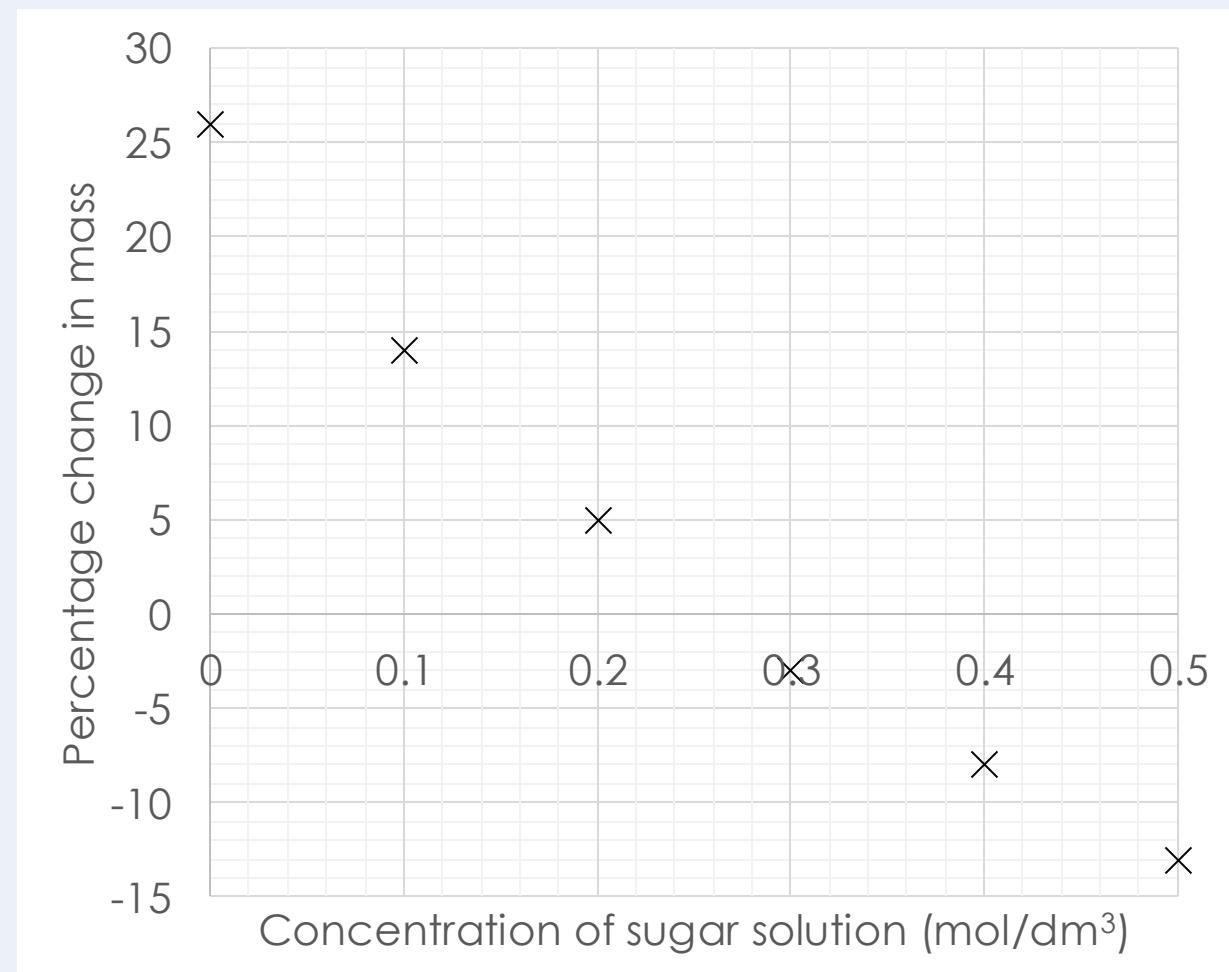
0%

**Explain** why.

Because this concentration of sugar solution is likely to be the same as the concentration inside the potato cells

So, the net movement of water would be zero

Apply



## Answer the questions below.

1. What was the independent variable in this experiment?

- Mass of potato cylinder
- Concentration of salt solution
- Change in mass of potato cylinder

2. What would you expect to happen if a piece of onion was left in a hypertonic solution?

- The onion would disappear as the cells would lyse
- The onion would decrease in mass.
- The onion would increase in mass.

3. What would you expect to happen if a sample of animal cells were left in a hypotonic solution?

- They would expand and become turgid
- They would expand and burst
- They would become shrivelled

## Lesson B3.1.10

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)  
or by emailing [sciencemastery@arkonline.org](mailto:sciencemastery@arkonline.org)  
Thank you!