

# Investigating Osmosis Lab

In this lab, students will investigate the properties of osmosis using potato slices.

## Biology 12

### **Curriculum Connections:**

BC Chemistry 12 (2006)

B2 - describe the characteristics of water and its role in biological systems

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# Biology: Investigating Osmosis Lab

A shipwrecked sailor is stranded on a small desert island with no fresh water to drink. She knows she could last without food for up to a month, but if she didn't have water to drink she would be dead within a week. Hoping to postpone the inevitable, her thirst drove her to drink the salty seawater. She was dead in two days. Why do you think drinking seawater killed the sailor faster than not drinking any water at all?

Today we explore the cause of the sailor's death. We'll prepare solutions of salt water to represent the sea, and we'll cut up slices of potato to represent the sailor. Potatoes are made of cells, as is the sailor!

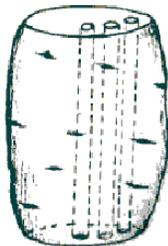
## Objective:

To determine the cause of the sailor's death, we will determine the effects of salt water on slices of potato. Our assumption is that potato cells will behave like the sailor's cells in her body. We will compare salt water to fresh water so we can see if there is an effect caused by the salt in the water. The fresh water acts as a control in this experiment.

## Procedure:

1. In order to determine if the salt in the water has an effect on the potato cells, we first need to cut four *equal sized* slices of potato to represent the sailor. The best way to do this is to core 2 long strips of potato 8 centimeters (cm) long. If necessary, trim the potato slice so that they all have sides. Cut the potato slice into two equal pieces, 3-4 cm long. **The goal is to end up with four potato slices of exactly the same size**, so that we can compare the effects of the water and the salt.

In order to draw any conclusions, the potato slices must be exactly the same size to begin with. It is important to enter the length of the potato slices into the data table so you can compare it to the size of the potato slice tomorrow! The table is on page two.



Square off the ends of the potato so that it is at least 8 cm long. Stand it on end and bore three vertical holes. **Space them close together so that one or two other groups can use the rest of the potato.**

Re-measure the cylinders you remove from the cork borer and, if necessary, recut them so that they are all exactly the same length. Record the actual length in the table.

2. Now make your sea water solutions. A bottle of 20% salt solution (sodium chloride) is provided. Take and label four cups as follows: 10%, 5%, 1% percent sea water and fresh water.
  - a. You must make the sea water solutions by diluting the concentrated 20% salt solution to 10%, 5%, and 1%.

**Calculations:**

$$\frac{\text{Concentration of stock solution}}{\text{Desired final concentration}} = \text{amount of dilution}$$

$$\frac{50 \text{ ml total volume}}{\text{amount of dilution}} = \text{amount of stock}$$

$$50 \text{ ml total} - \text{amount of stock} = \text{amount of water}$$

**Table 1**

Percent Sea Water	Vol. of 20% Salt Water (ml)	Vol. of Fresh Water (ml)	Total Vol. (ml)
10% Sea Water			100.0
5% Sea Water			100.0
1% Sea Water			100.0
Fresh Water	0.0	100.0	100.0

3. Place a slice of potato into each of the four cups. Cover the cups with saran wrap using a rubber band to hold the wrap securely in place. Why is it important to cover the cups overnight?

## Day Two

4. Measure the length of the potato slices being careful to make a note of which slice belongs to which cup! Enter the change in size into the data table. Use a plus (+) to indicate a slice has grown and a minus (-) to indicate a slice has shrunk overnight. (Example +2 mm means grew 2 mm / -3 mm means shrunk 3 mm).

Data:

**Table 2**

Sample	Initial Length (Day 1)	Final Length (Day 2)	Change in Length	Turgidity		Tonicity		
				Crisp	Flaccid	Hypo-	Iso-	Hyper-
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10 % Salt	cm.							
5% Salt	cm.							
1% Salt	cm.							
Fresh Water	cm.							

## Prepare a graph of your data.

Your instructor will give instructions on how to do this.

What are the variables we are testing in this laboratory?

What data are we collecting?

## Observations and Conclusions

1. Write a formal report of this lab using the usual format. In the discussion, you **MUST** address the following questions.
  - a. What happened overnight to the potato slices? Why did it happen?
  - b. Is diffusion or osmosis responsible for changes in length of the potato slices? Define both these terms.
  - c. Which of the three solutions is isotonic to potato cells? How do you know this?
  - d. Define hypertonic, isotonic, and hypotonic.
  - e. Why did the sailor die more quickly drinking salt water than not drinking at all? What do you think killed the sailor?