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Observing Osmosis

Introduction

Osmosis is the diffusion of water across a semipermeable membrane, from an area of high water concentration to an area of low water concentration. Osmosis also occurs in response to changing concentrations of water-soluble solutes. Osmosis can be observed in individual cells or in collections of cells, as in multicellular organisms or their structures. In this investigation you will use a grape's external membrane to demonstrate how osmosis can occur in solutions where there are changes in the concentrations of solutes.

Problem

How does solute concentration affect the movement of water across a biological membrane?

Pre-Lab Discussion

Read the entire investigation. Then, work with a partner to answer the following questions.

1. Explain the meaning of the term *water-soluble*.

_____

2. Why does the investigation ask you to blot the grape each time it is removed from a beaker?

_____

_____

3. What are some differences between the liquids used in the investigation?

_____

_____

4. What data will you record in Data Table 2?

_____

_____

5. Why do you need to record the times the grape was immersed?

_____

_____

Materials *(per pair)*

3 grapes	salt water
paper towels	marker
weighing container	3 plastic spoons
3 250-mL beakers	balance
distilled water	grape juice

Safety

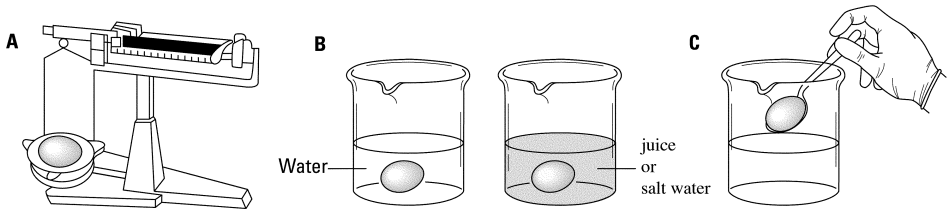
Put on safety goggles. Put on a laboratory apron. Be careful to avoid breakage when working with glassware. Always use caution when working with laboratory chemicals, as they may irritate the skin or stain skin or clothing.

Procedure

1. Wear your safety goggles, plastic gloves, and laboratory apron. Work in pairs. You will eventually share your data with other members of the class.

2. Obtain three grapes, provided by your teacher. Gently blot them on a paper towel and determine the mass of each, using correct procedure (use weighing paper or a container on the balance). Record the initial mass of each grape in the spaces provided in Data Tables 1, 2, and 3.

3. Place one grape in a beaker. Fill this beaker with distilled water to just cover it. See Figure 1. In Data Table 1 record the time the grape is placed in the water. Note the appearance of the water at this time and record your observation in Data Table 4. **CAUTION:** *Be careful to avoid breaking glassware.*



Determine the initial mass of each grape.

Place one grape in beaker, cover with water, and note the time. Place another in the second breaker, cover with salt water, and note the time. Place the last grape in a third beaker, cover with grape juice, and note the time.

After the grape has been immersed for 10 minutes, remove it from the beaker with a spoon and set it on a paper towel.

Figure 1

4. Place the other grape in a beaker. Pour salt water into the beaker to just cover the grape. In Data Table 2, record the time the grape is placed in the salt water. Note the appearance of the salt water at this time and record your observation in Data Table 3. Repeat this procedure using the third grape and the grape juice.

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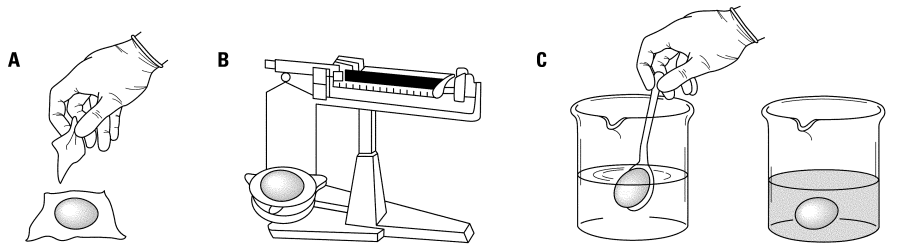
5. Using the marker, label the plastic spoons *water*, *salt water*, and *juice*. After 10 minutes have elapsed, use the correctly labeled plastic spoon to remove each grape from its beaker. Carefully blot the grape with a paper towel and determine the mass of the grape. See Figure 2. Record your data in Data Tables 1, 2, and 3. Gently return each egg to its appropriate beaker. Note the times again.



Carefully blot the grape dry.

Determine the mass of the grape.

Carefully return the grape to its beaker and note the time. Then remove the second grape, blot dry, determine its mass, and return it to the beaker of salt water. Repeat with the third grape and the grape juice, Continue the immersion and weighing process until the lab period ends.

Figure 2

6. Repeat step 5 every 10 minutes, as long as time permits. Record the masses of the grapes for each 10-minute interval in Data Table 1

7. After you have completed the last mass determination of the grapes in the 3 liquids, record the appearance of the water, salt water, and juice Data Table 4. **CAUTION:** *Wash your hands thoroughly after carrying out this lab.*

8. Determine the percent change in mass of each grape for each ten-minute interval by using the following formula:

$$\frac{(\text{mass after immersion} - \text{initial mass}) \times 100}{\text{initial mass}}$$

Record this percent mass change in Data Tables 1, 2, and 3.

Data Table 1: Grape in Distilled Water

Time (minutes)	Mass (grams)	% Mass change
In ____ Out ____	Initial mass ____	
In ____ Out ____	After 10 min. ____	
In ____ Out ____	After 20 min. ____	
In ____ Out ____	After 30 min. ____	
In ____ Out ____	After 40 min. ____	
In ____ Out ____	After 50 min. ____	

Data Table 2: Grape in Salt Water

Time (minutes)	Mass (grams)	% Mass change
In ____ Out ____	Initial mass ____	
In ____ Out ____	After 10 min. ____	
In ____ Out ____	After 20 min. ____	
In ____ Out ____	After 30 min. ____	
In ____ Out ____	After 40 min. ____	
In ____ Out ____	After 50 min. ____	

Data Table 3: Grape in Grape Juice

Time (minutes)	Mass (grams)	% Mass change
In ____ Out ____	Initial mass ____	
In ____ Out ____	After 10 min. ____	
In ____ Out ____	After 20 min. ____	
In ____ Out ____	After 30 min. ____	
In ____ Out ____	After 40 min. ____	
In ____ Out ____	After 50 min. ____	

Data Table 4: Appearance of Liquids

	Initial	Final
Distilled Water		
Salt Water		
Grape Juice		

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9. Graph the percent change in mass of each grape versus time using Figure 3. Use a different symbol or color for each grape.

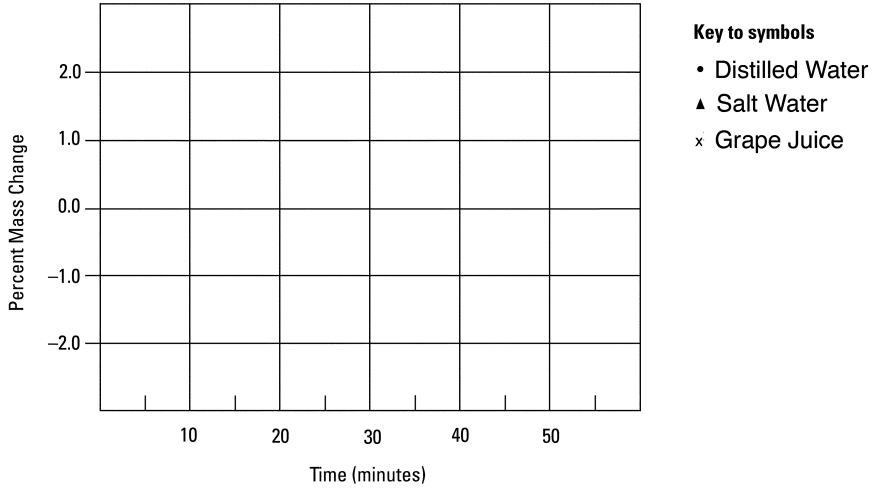

Figure 3

Analysis and Conclusions

1. Observing Did any grape gain mass over time? If so, which one(s)?

2. Observing Did any grape lose mass over time? If so, which one(s)?

3. Observing Describe any changes in the appearance of the liquids.

4. Inferring Explain why there were changes in the mass of the grapes, either a loss or gain.

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5. **Formulating Hypotheses** Explain any changes you observed in the appearance of the liquids.

6. **Forming Operational Definitions** Using the terms isotonic, hypotonic, and hypertonic as defined in your textbook, explain the changes in mass of the three grapes.

7. **Comparing and Contrasting** Were the results consistent throughout the class? If not, explain the sources of error that may have affected the results.

8. **Inferring** What might you infer if the juice's color became darker as time progressed?

9. **Formulating Hypotheses** In the past, meat was preserved by packing it in salt. Explain how this technique might prevent the growth of microorganisms.