

## **Biology**

### **Standard II, Objective 3**

**Title:** Models of Movement

**Description:** Students will perform two experiments using “bags” made of dialysis tubing. One measures the movement of iodine across the membrane into a bag filled with starch solution, where it turns black. This is an example of diffusion, water is not involved. The other experiment measures the movement of water (therefore, osmosis) into a bag of sugar.

**Materials** 2 beakers, starch solution (mix corn starch with water until no more will dissolve), saturated sugar solution (color it with food coloring to make it easier to see), dialysis tubing (3/4 to 1 inch works well), small rubber bands, iodine solution (IKI-iodine potassium iodide), student sheet (below)

**Time Needed:** 60-70 minutes

**Student Background Needed:** Students should be aware of the definitions for osmosis and diffusion. They should also understand that living membranes are able to let particles of a certain size through and can actively transport molecules that they need either inside or out. The package the dialysis membrane comes in should say what size particle can pass through it. Dialysis membranes, being non-living are unable to actively transport molecules against the osmotic pressure.

#### **Procedures:**

1. Read the introduction with students. If you know the particle size of your dialysis membrane you could share that with them.
2. In a beaker, demonstrate the effect of iodine solution on some of the starch solutions.
3. Go over the procedures with students. Show them where materials are located.
4. Allow time for data collection and have students post their results on the board by amount of mass the bags changed. Use + and – symbols to show gain or loss of mass.
5. Summarize with the class the results. It is very easy for the bags to leak. If a group of students have data that doesn't agree with the rest of the class, they probably had a leaker.

**Scoring Guide:**

1. Students collect and record data.....4
2. Students correctly answer analysis questions.....4

answers:

1. *What color does iodine turn in starch? Black or blue-black*
  2. *Did the iodine or starch move through the membrane in bag #1?*  
*Iodine*
  3. *What evidence do you have to prove that? The contents of the bag turn black and there is no black in the solution.*
  4. *Is iodine moving through a membrane osmosis or diffusion? diffusion*  
*Why? Water is not involved.*
  5. *Did the water or sugar move through the membrane in bag #2? water*
  6. *What is your evidence? The bag weighed more at the end*
  7. *Is the movement of water osmosis or diffusion? Osmosis Why? That is the definition of osmosis.*
  8. *What do you assume about the size of sugar and starch molecules?*  
*They are too large to pass through the membrane.*
3. Conclusion is thoughtfully and completely written.....4

**Title:** Models of Movement

name \_\_\_\_\_

**Introduction:** In a living cell, the cell membrane acts as a gatekeeper, allowing some substances inside the cell and moving others out. This is called active transport and it allows some large molecules in and keeps some small ones out. In this activity you will use a non-living membrane to model both diffusion and osmosis. The membrane is called “dialysis tubing” and it has very tiny holes in it that allows small molecules through and not large ones. Dialysis tubing is not able to perform active transport so particle size is the only thing that allows substances to move in or out.

**Materials:** 2 beakers, starch solution, sugar solution, dialysis tubing, rubber bands, iodine solution

**Procedure:**

**#1 bag**

1. Tie the end of a wet piece of dialysis tubing. Pour in some starch solution inside and tie off the other end with a rubber band.
2. Weigh the bag on a balance. Draw it in the “before” column.
3. Place the bag in an iodine solution and wait.
4. Dry the bag and reweigh. Draw it in the “after” column.
5. Find the change in mass by subtracting the “after” mass from the “before”.

**#2 bag**

1. Tie the end of a wet piece of dialysis tubing. Pour in some sugar solution so that the bag is only HALF full and tie off the other end with a rubber band.
2. Weigh the bag on a balance.
3. Place in a beaker with water and wait a few minutes. Reweigh the bag after drying it on a paper towel.
4. Record your results in the data.

**Data:** Draw the bags in the squares provided:

<b>Bag</b>	<b>Before</b>	<b>After</b>	<b>Change in Mass</b>
<b>#1</b>	Mass _____	Mass _____	
<b>#2</b>	Mass _____	Mass _____	

**Analysis:**

1. What color does iodine turn in starch?
2. Did the iodine or starch move through the membrane in bag #1?
3. What evidence do you have to prove that?
4. Is iodine moving through a membrane osmosis or diffusion?  
Why?
4. Did the water or sugar move through the membrane in bag #2?
5. What is your evidence?
6. Is the movement of water osmosis or diffusion?           Why/
7. What do you assume about the size of sugar and starch molecules?

**Conclusion:** 2 things you learned