



# TRIPLE DIFFUSION LAB-

# Part 1: Diffusion of Water with Gummy Bears (SB1a,d)



**Purpose:** To investigate the movement of water into and out of a cell model and to relate this movement to osmosis, hypotonic, isotonic and hypertonic solutions.

**Hypotheses:** (see below)

**Background:** Gummy bears are made of gelatin and sugar. Gelatin is a protein that adds structural support to jellies, jams, and many other things you use every day. Diffusion is the movement of materials from an area of high concentration to an area of low concentration. In this lab you will measure the movement of water by measuring the change in size of a gummy bear. Based on this information, formulate a hypothesis for each day of the lab.

**Procedure:**

**Initial Day (Day 1)**

1. Obtain 2 plastic cups, 2 gummy bears (the same color), and a ruler.
2. Label each cup with your name and class period using a permanent marker. Then label them #1 and #2.
3. Measure your bear (in mm) from top to bottom (length), from side to side (width), and from front to back (height). Also obtain the mass (g). Record these data in your data table.
4. Place a bear in each cup and fill the cups half way with water. Add 15 grams of salt to cup #2.
5. Place the cups in the designated area for 24 hours.

6. Calculate the volume of each bear ( $l \times w \times h$ ).

**Day 2**

7. Use a plastic spoon to gently scoop out each bear. BE CAREFUL not to break the bears, they are very fragile.
8. Measure the length, width, height and mass and record in your data table.
9. Make any observations about the color of the bears and/or the water.
10. Calculate the volume of each bear on Day 2 and record the mass

**Copy down the following tables beneath your hypothesis:**

<i>Initial - Day 1</i>	Length	Width	Height	Volume	Mass
Cup #1 water					
Cup #2 saltwater					

<b>Data Analysis</b>	<b>% change Day 1 to Day 2</b>
Cup #1 water-water	
Cup #2 saltwater	

<i>Day 2</i>	Length	Width	Height	Volume	Mass
Cup #1 water					
Cup #2 saltwater					

**Post Lab Analysis:**

1. What happened to the bears after being initially placed in water? (Look at your Day 2 results.) Explain the direction of water movement.
2. What happened to the bear that was placed in the salt water? Compare the direction of osmosis with the bear that was in the water only. Explain this disparity.
3. Explain any change in color in the bears or their solutions. Describe the movement of water that produced the results.
4. What do you predict would eventually happen to the bear in cup #1 if it was left in the water for a few more days?
5. Compare you data with the rest of the class. Did color appear to be a factor in the lab? If so, which color(s) changed the most in size from Day 1 to Day 2?
6. Explain the types of solutions you worked with on each day. Were the solutions hypertonic, hypotonic or isotonic? Justify your answer.
7. What did the gummy bear model in this lab? Was the gummy bear a realistic model? Please justify your response.

## TRIPLE DIFFUSION LAB-

### Part 2: Hydrophilic Spheres Diffusion (SB1 a, d)

#### Procedure:

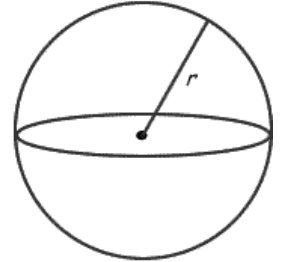
##### Initial Day (Day 1)

1. Obtain one hydrophilic sphere and a precision caliper.
2. Label each cup with your name and class period using a permanent marker. Then label it "sphere". NOTE: calipers are coated in protective grease during storage. Use a towel to wipe off the grease before you take any measurements.
3. Measure the diameter of the sphere to the nearest 0.5 mm using the calipers. Also obtain the mass (g). Record these data in your data table.
4. Place the sphere in a cup and fill the cup half way with water. Place the cup in a designated area for 24 hours.
5. Calculate the volume of the sphere ( $v=4/3\pi r^3$ ).

Sphere

Surface Area

$$A = 4 \pi r^2$$



Volume

$$V = \frac{4}{3} \pi r^3$$

##### Day 2

6. Use a plastic spoon to gently scoop the sphere. BE CAREFUL not to break the sphere as it is very fragile.
7. Measure the diameter of the sphere to the nearest 0.5 mm using the calipers. Also obtain the mass (g) and record in your data table.
8. Calculate the volume of the sphere ( $v=4/3\pi r^3$ ).
9. Calculate the percentage growth between day 1 and day 2.
10. Calculate the density of the sphere.

##### Day 3

11. Repeat these steps for day three. This may occur over the weekend. If so, make note of this information to correct for any sources of error.
12. Calculate the percentage growth between day 2 and day 3.
13. Calculate the density of the sphere.

**Data Table: Create a data table that is appropriate for your data set.**

#### **Post Lab Analysis:**

1. Write a paragraph that summarizes your results. Be sure to discuss the movement of water. Also discuss the percentage growth between the various days. It will also be necessary to discuss sources of error, especially if the experiment went over a weekend. Also discuss the density of the sphere. How could the data set be corrected, or extrapolated to account for any days in which the sphere was not measured?

## TRIPLE DIFFUSION LAB-

### Part 3: Starch / Iodine Diffusion Lab (SB1 a, d)

**Introduction:** In this lab you will observe the diffusion of a substance across a semi-permeable membrane. Iodine is a known indicator for starch. An indicator is a substance that changes color in the presence of the substance it indicates. Watch as your teacher demonstrates how iodine changes in the presence of starch. The purpose of this lab is to observe the movement of solutes in a concentration gradient, in an attempt to reach equilibrium (homeostasis).

**Pre-lab Observations:** Describe what happened when iodine came into contact with starch.

#### **Experimental Procedure:**

1. Fill a plastic bag with 10 grams of corn starch and a 25 ml of water then tie the bag. Obtain the mass of the cornstarch water bag.
2. Fill a cup with 150mL of water and add 15 drops of iodine with a transfer pipette.
3. Place the bag in the cup so that the cornstarch mixture is submerged in the iodine water mixture.

4. Wait 24 hours and record your observations in the data table. While you are waiting, record initial observations in the data table and answer questions 1-13 below.

### Pre-Lab Questions:

1. Compare and contrast the process of diffusion and osmosis.
2. The bag in this lab represents a model of a cell. How is this realistic representation?
3. Why is iodine used as an indicator (think back to Mag-Mush)?
4. Molecules that move by means of passive transport tend to move from areas of \_\_\_\_\_ concentration to areas of \_\_\_\_\_ concentration.

**We are going to think about concentrations now, which substances are more or less concentrated depends on which one has the most substance in it.**

5. Is the bag or cup more concentrated in starch?
6. Is the bag or cup more concentrated in iodine?
7. What macromolecule could starch be categorized as? What type of cell transport is required for these types of molecules?
8. Explain the difference between passive transport and active transport. Predict which one you will be observing?

### Make Some Predictions:

9. If the bag was permeable to starch, which way would the starch move, into the bag or out of the bag?
10. If the bag was permeable to iodine, which way would the iodine move, into or out of the bag?
11. If the bag was permeable to iodine, what color would you expect the solution in the baggie to turn?
12. If the bag was permeable to starch, what color would you expect the solution in the bag to turn?
13. Make a hypothesis about what you think will happen and justify your thoughts.

### Data Table: Monitoring color change of the solutions.

	Initial	24 hours
<b>Solution in Beaker COLOR</b>		
<b>Solution in Bag COLOR</b>		
<b>Mass of bag (g)</b>		

### Post Lab Analysis:

1. Based on your observations, which substance moved, the iodine/water solution or the starch?
2. How did you determine this and **why** do you believe this occurred?
3. The plastic baggie was permeable to which substance?

4. Is the plastic baggie selectively permeable? Why, what does it mean to be selectivity permeable?
5. Sketch the cup and bag and label arrows to illustrate how diffusion occurred in this lab.
6. Explain what would happen if you did an experiment in which the iodine solution was placed in the bag, and the starch solution was in the beaker? Be detailed in your description. You can even do the experiment if you would like!
7. Describe the difference in color of the iodine solution initially compared to the iodine solution at the end of the experiment?
8. Did you see a difference in the mass of the bag? Explain why or why not.
9. Explain the difference between qualitative and quantitative data, citing examples of each in this lab.
10. *SB3a Connection:* Thoroughly examine the below schematic diagram. Construct an essay to explain the mechanism and importance of this process. You must use and underline the following terms in your essay. You may choose to create a flow map to help you.

Terms to use: **macromolecule**, **ATP**, **phospholipid**, **glucose**, **concentration gradient**, **amino acids**, **hydrophobic**, **homeostasis**, **fatty acids**, **hydrophilic**, **cellular respiration**

