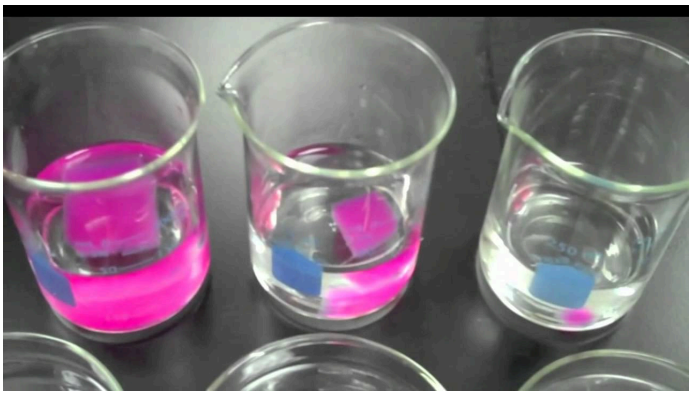
Name: _____

Course: APBIO
Teacher: Rozema
Period: 6



Unit 2: Surface Area + Volume Lab

Background:

Diffusion is the movement of a substance from an area of higher concentration to an area of lower concentration. While cells utilize a number of methods for transporting materials in and out of the cell (such as osmosis, facilitated diffusion, and active transport), diffusion requires no energy and no extra proteins or cell organelles. In other words, diffusion is a cheap (energy-wise) and efficient way for the cell to move stuff it has to move. Molecules like Oxygen Gas, Carbon Dioxide Gas, and Glucose can diffusion through the cell membrane with no energy cost to the cell.

We will be modeling the cell using cubes of agar (a gelatin-like substance from seaweed). The agar has been soaked in Bromothymol Blue (a pH indicator that turns yellow when the pH drops below 6.9). The cubes have been stored in 0.01% Sodium Hydroxide (a strong base), causing the cubes to have a deep blue color. We are going to soak our agar cubes in Vinegar (an acidic solution).

To add one extra piece to this lab, we will also be observing what happens to our agar cubes, if they are different sizes and/or shapes, to explore how the surface area of the cubes affects diffusion.

Materials:

- Agar
- Scalpels/Knife
- Rulers
- Gloves
- Vinegar
- Beakers
- Digital Scales
- Timers (Phones)
- White Paper

(Utilized only by teacher)

- Bromothymol Blue
- Agar Powder
- Graduated cylinder
- Distilled Water
- Whisk / Fork
- Large Beaker / Flask
- Hot Plate
- Glass Baking Pan / Silicone Ice Cube Trays

Set Up (Teacher):

1. Measure 1.6g of Agar.
2. Measure 200mL of Distilled Water.
3. Mix the Agar and Water together in a large beaker / flask
4. Heat the solution till boiling and remove.
5. Add a few drops of Bromothymol Blue to the Agar Solution. (The mixture should turn blue).
   *If it has a greenish hue, add Sodium Hydroxide / Ammonia a drop at a time till it turns blue.
6. Pour the Agar Solution into the ice-cube molds (or your small baking pan).
   *Make sure the agar blocks are at least 3cm deep when cooled and solidified.
7. Let the agar cool until solidified.

PART 1: Pre Lab Questions

(1) What is Diffusion?

_____

_____

_____

_____

(2) What will be diffusing in this lab? _____

(3) Where will there initially be a HIGHER CONCENTRATION of our solution?

_____

(4) Where (initially) is there a LOWER CONCENTRATION of our solution?

_____

(5) What direction will our solution diffuse in?

_____

(6) What color will the agar jelly be initially? _____

(7) What color will the agar jelly turn if it interacts with vinegar? _____

(8) Visually, how will we know that our solution has diffused?

_____

(9) What is the equation for the Surface Area of a Cube? _____

(10) What is the equation for the Volume of a Cube?

_____

(11) What is a Ratio?

_____

_____

(12) How do you think the SIZE of the agar cube will affect the DIFFUSION RATE of the vinegar? Discuss.

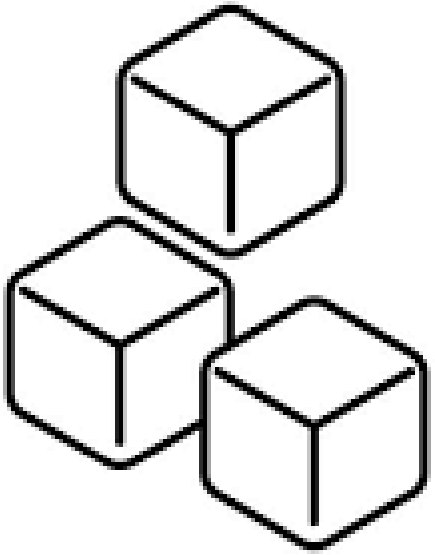
_____

_____

_____

_____

_____



Procedure (Students):

1. Place 1 Agar Cube in each Beaker / Cup.
2. DO NOT ADD THE VINEGAR YET! BUT…
   You will pour enough Vinegar into each beaker, to completely cover each cube.
3. Do 1 cup / cube at a time.
4. The moment you start pouring vinegar into a cup → START TIMING!
5. Once you see the ENTIRE CUBE change from BLUE TO PALE YELLOW → STOP TIMING!
6. Record the TOTAL TIME for each cube.

PART 2: Data Collection

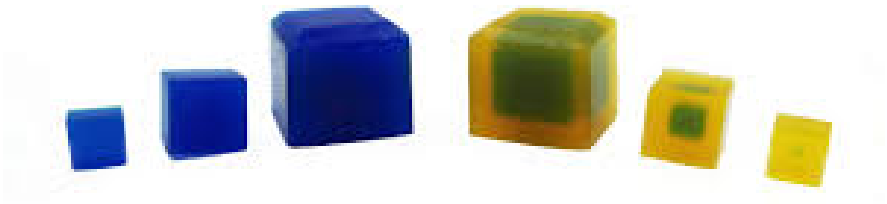
Data	_____ Agar Cube	_____ Agar Cube	_____ Agar Cube
Surface Area Calculation:			
Volume Calculation:			
Surface Area : Volume Ratio			
Initial Color:			
Total Time for Diffusion:			
Final Color:			
Diffusion Rate Calculation (cm^3 / sec):			

PART 3: Graphing

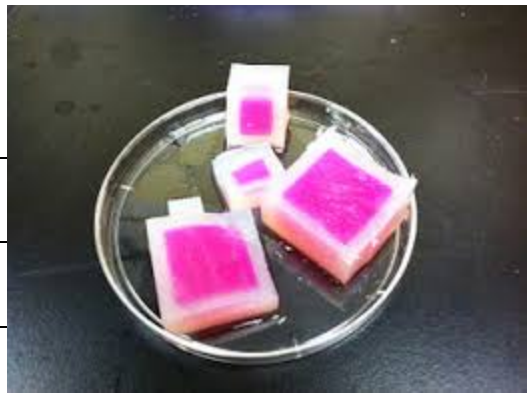
Graph the Surface Area to Volume Ratio versus the Diffusion Rate of each Agar Cube below.

Make sure to include:

- ☐ Labels on both the X and Y Axes.
- ☐ Units where relevant.
- ☐ A Title for the graph.
- ☐ Plot the points.
- ☐ Draw a line of best fit through the data points.
- ☐ Increments



PART 4: Conclusion



(1) What conclusions can you make from the lab graph?

(2) How could the Surface Area and Volume of a living organism or cell, could affect the Diffusion Rate in/out/through the organism, and how that could affect the organism's ability to maintain homeostasis. What could be an advantage of being a larger cell? What would be the disadvantage of being a larger cell? How do organisms like animals get around the "big cell" disadvantage?