

Does Cell Size Count

In this experiment you will be using agar blocks of to represent cells. The blocks contain phenolphthalein, a pH indicator dye. You will soak the blocks in NaOH for ten minutes; this will turn the phenolphthalein pink. You will then determine which block shows the greatest diffusion of the NaOH.

Objectives:

1. Determine the effect of cell size on diffusion
2. Discover the relationship between surface-area and volume
3. Discuss why cells divide

Materials:

- plastic spoon
- scalpel
- 3 agar blocks of different sizes (3.0 cm, 2.0 cm, 1.0 cm)
- small metric ruler
- paper towels
- 500 ml beaker filled with 250 ml of 0.4% NaOH
- gloves and goggles

Procedure:

1. Using the spoon, carefully place all three cubes in the beaker of NaOH
2. Swirl the beaker gently and begin timing immediately.
3. Let the experiment run for ten minutes
4. While the experiment is running complete Table 1.

Table 1

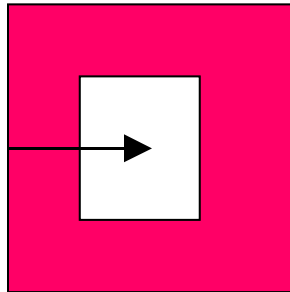
Cube Size	Surface Area (cm²)	Volume (cm³)	Surface Area to Volume Ratio
1 cm			
2 cm			
3 cm			

surface area= number of surfaces X length X width

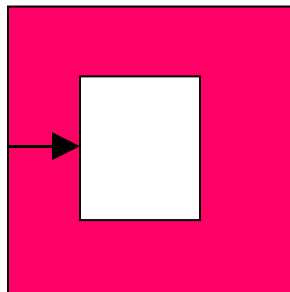
volume = length X width X height

surface area to volume ratio = $\frac{\text{surface area}}{\text{volume}}$

5. At the end of ten minutes use the spoon to remove the cubes from the beaker and blot each gently using a paper towel.
6. Cut each cube in half using the scalpel
7. For each cube calculate the distance **in mm** from the edge of each cube to the center of each cube. Do this by recording the length of one side by 2. Record this in Table 2.



8. Using the ruler, measure the distance in mm that the NaOH has traveled into the cube and record this in Table 2.



9. Calculate and record in Table 2 the percent of the total distance the NaOH has traveled.

$$\% = \frac{\text{distance traveled}}{\text{total distance}} \times 100$$

Table 2

Cube Size	Total Distance to Center of Cube (mm)	Distance NaOH has Diffused (mm)	% Distance the NaOH has Travelled
1cm			
2cm			
3cm			

Conclusions: answer in complete sentences.

1. Which block has the greatest surface area?
2. Which block has the greatest surface area to volume ratio?
3. Into which block did the NaOH diffuse the most?
4. If the blocks were actual cells, which would be the most efficient in terms of permitting materials to diffuse across the cell membranes.
5. What happens to the surface area to volume ratio of a cell as it grows?
6. If you drop a sugar cube in a cup of water and an equal amount of granulated sugar in another cup of water, which will dissolve faster? Why?
7. Based on this experiment what is an advantage of being multicellular as opposed to single cellular?

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