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Anatomy & Physiology 12
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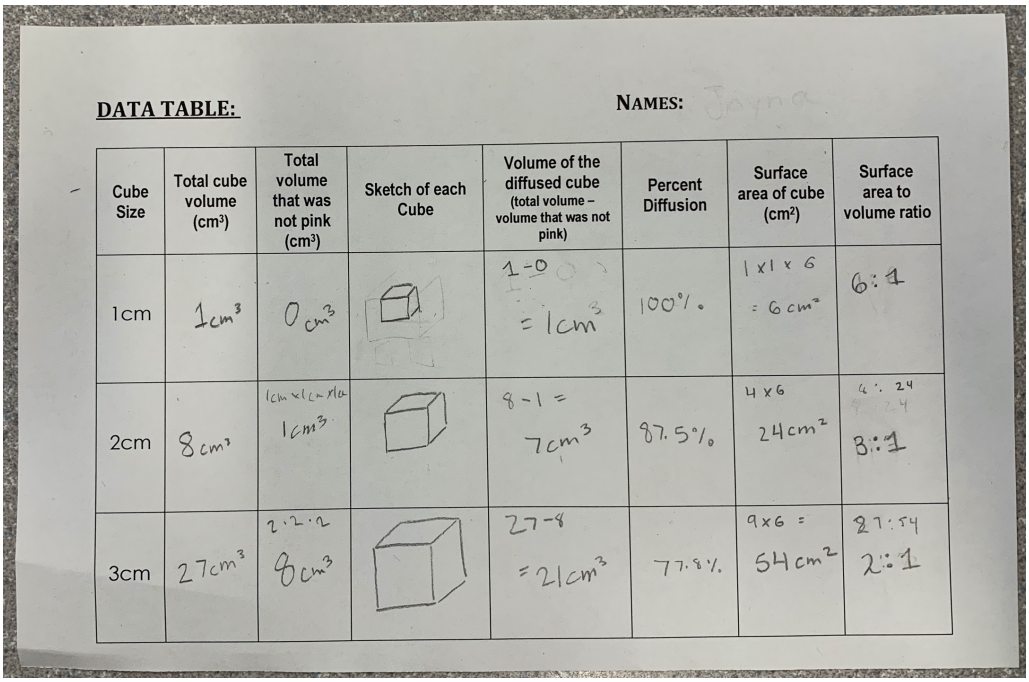
Ms. Yorke

Diffusion in Agar Cubes

Picture of Agar Cubes

Data Table



DATA TABLE: NAMES: Jayna

Cube Size	Total cube volume (cm^3)	Total volume that was not pink (cm^3)	Sketch of each Cube	Volume of the diffused cube (total volume – volume that was not pink)	Percent Diffusion	Surface area of cube (cm^2)	Surface area to volume ratio
1cm	$1cm^3$	$0cm^3$		$1-0 = 1cm^3$	100%	$1 \times 1 \times 6 = 6cm^2$	6:1
2cm	$8cm^3$	$1cm \times 1cm \times 1cm = 1cm^3$		$8-1 = 7cm^3$	87.5%	$4 \times 6 = 24cm^2$	4:24 3:1
3cm	$27cm^3$	$2 \cdot 2 \cdot 2 = 8cm^3$		$27-8 = 21cm^3$	77.8%	$9 \times 6 = 54cm^2$	27:54 2:1

Conclusion Questions

1. **In terms of maximizing diffusion, what was the most effective size cube that you tested?**
   In terms of maximizing diffusion, the most effective size cube that I have tested was the smallest cube (1 cm^3) since it was fully diffused.

2. **Why was that size most effective at maximizing diffusion? What are the important factors that affect how materials diffuse into cells or tissue?**
   The smallest cube (1 cm^3) was the most effective as maximizing diffusion. Since it is a small cube, it has a large surface area to volume ratio. The important factors that affect how materials diffuse into cells or tissue is the size; when a cell grows, there's comparatively less membrane for the substances to diffuse through which results in the centre of the cell not receiving the substances that it needs. However, after the cell divides into two smaller cells, each having a larger SA:V ratio, would result in being able to diffuse materials more efficiently again.

3. **If a large surface area is helpful to cells, why do cells not grow to be very large?**
   Cells do not grow to be very large even if a large surface area is helpful to cells is because it is less efficient at diffusing materials into the centre of the cell. As shown above in the picture of the Agar Cubes, the bigger cubes did not change the colour on the inside as the NaOH had not fully diffused in. Therefore, larger cells take longer and is less efficient at diffusing materials into the centre of the cell.

4. **You have three cubes, A, B, and C. they have surface to volume ratios of 3:1, 5:2, and 4:1 respectively. Which of these cubes is going to be the most effective at maximizing diffusion, how do you know this?**
   The cube that is going to be the most effective at maximizing diffusion is cube C with the 4:1 surface area to volume ratio since it has the largest SA:V ratio out of all of the other cubes. A large SA:V ratio means that it will allow diffusion to be the most effective and has a better opportunity to absorb the necessary materials.

5. **How does your body adapt surface area-to-volume ratios to help exchange gases?**
   Human bodies adapt surface area to volume ratios to help exchange gases because humans are multicellular organisms. When a cell gets larger, our cells have the ability to divide it into two smaller cells to maintain the most effective SA:V ratio. This allows for them to have features like gas exchange (lungs). However, if this ratio decreases, the rate of gas exchange will also decrease.

6. **Why can't certain cells, like bacteria, get to be the size of a small fish?**
   Certain cells like bacteria can't get to be the size of a small fish because bacteria are unicellular organisms. Unicellular organisms are made up of only one cell – meaning that they are small in size. Their small size means that they have a large SA:V ration and is adequate for many materials to move into and out of the cell by diffusion and active

transport but it limits the organisms size, thus, once it gets too big, they must divide – unable to become the size of a small fish.

7. **What are the advantages of large organisms being multicellular?**
   Plants and animals are multicellular organisms – the advantages of large organisms being multicellular is that it overcomes the problems of small cell sizes. Each cell has a large SA:V ratio but they have evolved features such as gas exchange organs (lungs) and circulatory system (blood) to speed up and aid the movement of materials into and out of the organism.