**Cell Surface Area**

**Objectives:**

1.Determine the surface area to volume ratio and relate this to cell size, in order to determine why cells divide.

2. Understand the problem cell growth causes and how cell division solves the cell growth problem.

**Directions:** Use the following equations to help you complete the data table below. (*s* = the length of one side of the cube)

Surface Area = 6 × *s* × *s*

Volume = *s* × *s* × *s*

Surface Area to Volume Ratio: divide the surface area by the volume

**Data Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cube Size** | **Surface Area (cm2)** | **Volume****(cm3)** | **Surface Area to Volume Ratio** | **Distance the Solution Traveled into the Cube** |
| 1 × 1 × 1 cm |  |  |  |  |
| 2 × 2 × 2 cm |  |  |  |  |
| 3 × 3 × 3 cm |  |  |  |  |

**Analysis**

1. If the agar cubes were cells, what types of substances might move into them?

2. How does this activity model diffusion of substances into cells?

3. Which “cell” do you think would have the best chance for survival? Why?

**Conclusion: Answer the following question in a paragraph:**

Which cell would have a better chance for survival, one that is 1 × 1 × 1-cm or one that is

0.1 × 0.1 × 0.1-cm? Why?

**Cell Surface Area—Answer KEY**

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cube Size** | **Surface Area (cm2)** | **Volume****(cm3)** | **Surface Area to Volume Ratio** | **Distance the Solution Traveled into the Cube** |
| 1 × 1 × 1 cm | 6 cm2 | 1 cm3 | 6:1 | Answers should be about the same for all three cubes (about 5 mm). |
| 2 × 2 × 2 cm | 24 cm2 | 8 cm3 | 3:1 |  |
| 3 × 3 × 3 cm | 54 cm2 | 27 cm3 | 2:1 |  |

**Analysis**

1. If the agar cubes were cells, what types of substances might move into them?

Answers will vary, but may include: nutrients, salts, and water.

2. How does this activity model diffusion of substances into cells?

This activity models diffusion of substances into cells because the agar cubes represent cells and the phenolphthalein represents a substance that is diffusing across the cell membrane (outside of the cube).

3. Which “cell” do you think would have the best chance for survival? Why?

Answers will vary; the 1 × 1 × 1-cm “cell” would have the best chance for survival, because it has the largest surface area-to-volume ratio, and is therefore the most efficient at transporting substances throughout.

**Conclusion: Answer the following question in a paragraph:**

Which cell would have a better chance for survival, one that is 1 × 1 × 1-cm or one that is

0.1 × 0.1 × 0.1-cm? Why?

The 0.1 × 0.1 × 0.1-cm cell would have a better chance for survival, because it has a larger surface area-to-volume ratio. Smaller cells are more efficient at transporting substances throughout. The surface area-to-volume ratio of the 0.1 × 0.1 × 0.1-cm cell is 60:1, and the surface area-to-volume ratio of the 1 × 1 × 1-cm cell is 6:1.