Name ______________________________ Class _______________ Date _____________

Quick Lab **MODELING**

Modeling Cells: Surface Area to Volume

Are there limits to how large a cell can grow? Everything that enters and exits a cell passes through the cell membrane. As the size of a cell increases, its surface area increases, but so does its volume. Consider how people enter a crowded event at a large stadium. Everyone funnels through a few gates. In a larger stadium, it takes people longer to move in and out. Similarly, in a larger cell, it takes materials longer to reach their destination inside the cell. This means that it is more difficult for a large cell to have its needs met through the cell membrane. In this lab, you will examine surface area-to-volume ratios on a small scale, using model cells. You will use the collected data to draw conclusions about why this ratio might limit the size of a cell.

OBJECTIVES

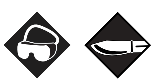
Prepare and **compare** various cell models.

Calculate surface area and surface area-to-volume ratios.

Use your data to form conclusions about size limitations on cells.

MATERIALS

- calculator (optional)
- cell model patterns (3)
- funnel
- graduated cylinder, large
- metric ruler
- paper, heavy
- safety goggles
- sand
- scissors
- tape



Procedure

1. Put on your safety goggles. Trace and cut out three cell models. Your teacher will provide you with the patterns or dimensions for each model. Fold the models to form three-dimensional shapes, as in **Figure 1.** Use tape to keep each model together.
2. Use the ruler to measure the length, width, and height dimensions of each model. Record the dimensions in **Table 1.**
3. Calculate the total surface area for each model. To do this, find the area of each side (length × width), then multiply that number by 6. Enter the data in **Table 1.**

FIGURE 1 CELL MODEL

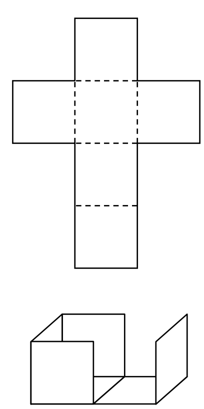


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TABLE 1 MODEL CELL CALCULATIONS

Cell	Dimensions (cm)	Surface area (cm^2)	Volume (cm^3)	Surface area-to-volume ratio
A				
B				
C				

4. Use the funnel to fill each model with sand. Use the ruler to level off the sand.
5. Find the volume of sand in each model, and enter the data in **Table 1.** You can do this by using either of two methods.
   a. Measure the amount of sand in each model by pouring the sand through a funnel into a graduated cylinder.
   b. Calculate the volume, using the following formula:

      volume = length × width × height
6. Calculate the surface area-to-volume ratio for each model. Use the following formula:

   surface area ÷ volume = surface-to-volume ratio

   Record the values in **Table 1.**

Analysis and Conclusions

1. **Evaluating Methods** Why do you need to multiply by 6 in step 3?

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2. **Summarizing Data** Which cell model has the largest surface area? the largest volume? the largest surface area-to-volume ratio?

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3. **Drawing Conclusions** Which model cell is likely to be most efficient at getting nutrients to all of the cell parts? Explain your answer in terms of surface area-to-volume ratios.

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