**Shape and SA/V Activity**

**Introduction**

The surface area (SA) of a 3-dimensional shape is the sum of the areas of all of its faces. In other words, surface area would be the amount of paper it would take to wrap up that entire object. The volume (V) of a 3-dimensional shape is the amount of space within it or the amount of clay it would take to make that shape. The surface-area-to-volume ratio (SA/V) is the amount of surface a structure has relative to the size of that structure. It can be found by dividing the surface area of an object by the volume of that object.

In this activity you will explore how surface area, volume and shape affect the surface-area-to-volume ratio.

**Materials**

* Metric Rulers
* Scientific Calculators/Excel
* Playdoh\*\*\*

**Procedure**

*Part A:*

Consider a cube with a volume of approximately 100 cm3. Choose approximate dimensions for this volume and calculate the surface area. Divide the volume by 100 and recalculate the surface area. Repeat a total of 5 times. Calculate the surface-area-to-volume ratio for all 5 times. Graph the relationship between 1) volume and length/radius, 2) surface area and length/radius and 3) SA/V and length/radius of the object.

Repeat this procedure with a sphere.

*Extension Activity:*

Using the same shape with the same initial dimensions, calculate the surface area. Keeping the total volume the same, divide the shape into smaller segments and recalculate the combined surface area of all the segments each time. Repeat a total of 5 times. Graph the same variables as above.

If you have time and want a challenge, repeat both procedures with a cone or cylinder.

\*\*\*The Playdoh can be used to help you better visualize the 3-D object and what happens when you divide it into smaller segments.

**Questions to Consider**

1. Do you observe a trend in how the surface-area-to-volume ratio changes as the length/radius of the object changes? Explain.
2. How does the surface area change in relation to the volume of the shape?
   1. Does the surface area and volume change at the same rate?
3. How does the SA/V ratio change with different shapes?
   1. Which shape has the largest SA/V? Why?
4. What type/s of graph/s did you choose? Why?
5. How does SA/V relate to the concept of size and scale?
   1. What conclusions can you make about the surface-area-to-volume ratio at the nanoscale?
6. How can you help your students understand the relationship between surface area and volume?
   1. What misconceptions could your students have related to surface area and volume?

**References**

<http://www.nano-link.org/nano-infusion-project/nanoscience-fundamentals> (free registration before download)

<http://www.learner.org/interactives/geometry/area_volume.html>

<http://mathcentral.uregina.ca/RR/database/RR.09.07/cotcher/svr/index.html>

https://adapaproject.org/bbk/tiki-index.php?page=Leaf%3A+Why+is+surface-to-volume+ratio+so+important+in+biology%3F