

Teacher Notes Pages

To the Teacher:

Students will gain experience measuring, calculating and graphing the ratio of circumference to diameter of a circle, and ratio of volume to area of a cylinder (optional.) They will gain understanding of the significance of the slope of a graph as well as experience in interpreting graphs and using them to make predictions. Through this activity, the student will have a better understanding of how scientists can extrapolate actual measurements they make to predict the size, shape and density of objects too small to measure.

The graphing activity allows students to see the relationship between the circumference and the area and how we use slope to show a constant value for pi. The slope of this line is equivalent to the change in circumference divided by the change in diameter which is equal to pi. Students probably have only memorized the value of pi and have never actually collected data to verify this constant. There are many constants in science, Planck's constant, for example, which is also determined from a linear relationship between energy and wavelength.

Lab Tips: Finding "medium" size pretzels may be difficult so use too different brands of the smaller pretzels. Make a visual observation that there is a difference in the size. Also, if not using calipers, have students wrap the pretzels with a string so that it overlaps. Mark the center of the overlap (both strings) and remove the string and cut both marks.

Websites:

<http://www.nanitenews.com/>

<http://electrospun.blogspot.com/>

Possible Data Table:

It is very important that students construct their own data tables. This allows them to think about what measurements must be made in order to accomplish the lab objectives. It is recommended that the teacher look at data tables as students perform the lab so that omissions in the table may be addressed.

Sample Data Table

Trial	Radius mm	Diameter mm	Circumference mm	Height mm	Cross Sectional Area mm ²	Volume mm ³	Surface Area	Surface Area to Volume Ratio
							mm ²	mm ⁻¹
1				100				
2				100				
3				100				
Ave				100				
1				100				
2				100				
3				100				
Ave				100				
1				100				
2				100				
3				100				
Ave				100				

Additional Activities:

1. **Graph** surface area /volume v. radius placing the radius on the x-axis.
2. What relationship exists between the radius (size) and the surface-to-volume ratio?
3. Predict the surface/volume ratio for a 400 nm nanofiber.

Sample graphs:

