Core Content

Cluster Title: Explain volume formulas and use them to solve problems.
Standard G.GMD.1: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. (Use dissection arguments, Cavalieri's principle, and informal limit arguments.)
Concepts and Skills to Master
• Develop the formulas for the circumference of a circle, area of a circle, and volume of a cylinder, pyramid, and cone using a variety of arguments.

Supports for Teachers

Critical Background Knowledge
• Use mathematical language and a logical progression of ideas to present an argument.
Academic Vocabulary
cylinder, right prism, pyramid, cone, dissection argument, Cavalieri's principle, limit argument

Suggested Instructional Strategies	Resources
• Use Archimedes' argument of fitting *n*-gons of increasing number of sides into a circle to approximate the circumference or area of a circle. • Dissect a circle into pizza slices, then rearrange the slices into a shape that approximates a parallelogram; find the area.	• Estimating Circumference of a Circle: http://www.cut-the-knot.org/Curriculum/ Calculus/GoodLimit • Pi Filling, Archimedes Style: http://illuminations.nctm.org • Circle: Wolfram Math World: http://mathworld.wolfram.com/Circle.html

Sample Formative Assessment Tasks	
Skill-Based Task: Explain why the volume of a cylinder is $V = \pi r^2 h$.	**Problem Task:** Find the volume of the Great Pyramid of Giza.

Core Content

Cluster Title: Explain volume formulas and use them to solve problems.
Standard G.GMD.3: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★
Concepts and Skills to Master
• Find the volume of cylinders, pyramids, cones, and spheres in contextual problems.

Supports for Teachers

Critical Background Knowledge	
• Formulas for the volumes of cones, cylinders, and spheres (8.G.9).	
Academic Vocabulary	
pyramid, cylinder, cone, sphere, volume, length, width, height, base, radius, π.	
Suggested Instructional Strategies	**Resources**
• Have students bring household objects with the given characteristics. Provide opportunities for students to measure with rulers or tape measures to gather needed information. Compute the volume of the objects. • Make connections between metric measurements. (For example, using rice to fill a cylinder compare the liquid volume in liters and the geometric volume in cubic meters.)	
Sample Formative Assessment Tasks	
Skill-Based Task: Find the volume of a cylindrical oatmeal box.	**Problem Task:** Given a three-dimensional object, compute the effect on volume of doubling or tripling one or more dimension(s). (For example, how is the volume of a cone affected by doubling the height?)