Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Mathematics	Course:	Geometry (Honors)	Unit 8 Title:	Surface Area & Volume (3D)	Grade Level(s):	8, 9, 10
Assessed Trimester:	Trimester B	Pacing:	High School: 8 - 11 Middle School: 8 - 13	Date Created:	05/22/2014	Last Revision Date:	08/20/2014

Course Understandings: *Students will understand that:*

A. Some problems require proportional thinking in order to be solved.
D. Transformations are performed to affect the figure.
E. Known geometric measurements are used to derive formulas of two- and three- dimensional figures in order to be used in real world situations.
F. Properties of two- and three-dimensional figures can be used in classification and problem solving.
G. Visualization, spatial reasoning and geometric modeling can be used to solve geometric problems.
H. Algebraic models can be used to solve geometric problems.

DESIRED RESULTS (Stage 1) - WHAT WE WANT STUDENT TO KNOW AND BE ABLE TO DO?

Established Goals

Minnesota State/Local/Technology Standard(s) addressed (2007):

- **Standard (9.3.1.#):** Calculate measurements of plane and solid geometric figures; know that physical measurements depend on the choice of a unit and that they are approximations.
  Benchmark:
  9.3.1.1 Determine the surface area and volume of pyramids, cones and spheres. Use measuring devices or formulas as appropriate.
  9.3.1.2 Compose and decompose two- and three-dimensional figures; use decomposition to determine the perimeter, area, surface area and volume of various figures.
  9.3.1.3 Understand that quantities associated with physical measurements must be assigned units; apply such units correctly in expressions, equations and problem solutions that involve measurements; and convert between measurement systems.
  9.3.1.4 Understand and apply the fact that the effect of a scale factor k on length, area and volume is to multiply each by k, k2 and k3, respectively.

Transfer

Students will be able to independently use their learning to: (product, high order reasoning)

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Meaning

Unit Understanding(s):	Essential Question(s):
Students will understand that: • they can determine the surface area and volume of pyramids with a variety of bases, including both right and oblique. Computations should be made using both physical models with measurement tools and diagrams or descriptions with appropriate formulas. • they can determine the surface area and volume of cones, including both right and oblique. Computations should be made using both physical models with measurement tools and diagrams or descriptions with appropriate formulas. • they can relate the slant height, height and radius of a cone using the Pythagorean Theorem.	**Students will keep considering:** •

- they can determine the surface area and volume of spheres and hemispheres. Computations should be made using both physical models with measurement tools and diagrams or descriptions with appropriate formulas.
- Compose individual 3-dimensional shapes into compound shapes to model real objects.
- Decompose compound figures into single figures by breaking them apart along appropriate faces. Use appropriate formulas to calculate their perimeters, areas, surface areas and volumes of the needed portions of the single figures.
- Use correct units when expressing solutions to length, area and volume problems.
- Convert solutions to length, area and volume problems between measurement systems.
- Estimate solutions to length, area and volume problems.
- Students should be able to calculate lengths, areas and volumes of similar figures.
- Students should be able to recognize scale factors.
- Students should be able to square ratios (take them to the second power) and cube ratios (take them to the third power).
- Students should be able to take the square root of ratios and the cube root of ratios.
- Students should recognize which scale ratio is needed to solve the given problem (length, area, or volume).

Acquisition

Knowledge - Students will:

- Identify 3-dimensional solids and their surface area and volume formulas:
  - Polyhedra
  - Pyramids
  - Cones
  - Spheres
  - Prisms
  - Cylinders
- Know formulas related to circles:
  - Area of a circle
  - Area of a sector
- Identify parts of solid (e.g., height vs. slant height, area of Base vs. base, lateral faces, etc.)
- Recognize when to decompose a figure
- Identify correct formula(s) for individual decomposed figures
- When finding surface area or volume, the sum of all of the parts of a figure is equal to the whole
- Understand the differences in measurement labels—linear, area, volume
- Understand the relationship between similar solids

Reasoning - Students will:

- Distinguish between heights and slant height of solids
- Distinguish correct formulas for surface area and volume
- Understand when it is appropriate to use surface area vs. volume
- Judge accuracy of values and make reasonable estimates for real-world problems using appropriate units of measure.
- Compare and contrast the results of using decimal approximations vs. exact fractional/radical values

Skills - Students will:

- Use formulas to determine surface area and volume.
- Demonstrate the ability to find measurements of parts of solids given surface area and volume.
- Calculate height or slant height using the Pythagorean Theorem.
- Use measuring devices to find lengths critical to using formulas.
- Decompose 2- and 3-dimensional figures into simpler shapes with known formulas and find the area and volume
- Demonstrate and calculate proportional change of areas and volumes when scale factor changes

Common Misunderstandings

- Students believe that the volumes of pyramids and cones are one-half the volumes of their associated prisms and cylinders.
- Students include areas of faces where composed figures adjoin when computing surface area.

Essential new vocabulary

- cone
- cylinders
- edges

• Students get confused about which type of units should be used to label their solutions. • Students invert conversion fractions when changing units. • Students believe all dimensions have the same similarity ratio. • Students confuse squaring ratios and using the square root of ratios when converting between linear and area ratios. • Students confuse cubing ratios and using the cube root of ratios when converting between linear and volume and ratios.	• faces • height (altitude) • polyhedra • prisms • pyramid • regular polygon • slant height • sphere • vertices • volume