**Unit Title: "Filling and Wrapping"**

**Course: Middle School Mathematics**

**Subject Area: Mathematics**

**Time Frame: 20 days**

**Standards**

| **Middle School Mathematics Standards** | **Sunshine State Standards Benchmarks** | **NCEE New Standards** |
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| The student will:<br><br>13.1 Conceptualize volume as a measure of *filling* an object.<br>13.2 Conceptualize surface area as a measure of *wrapping* an object.<br>13.3 Find volumes and surface areas for rectangular prisms.<br>13.4 Find volumes and surface areas for cylinders.<br>13.5 Reason about problems involving the surface areas and volumes of rectangular prisms, cylinders, cones, and spheres. | MA.B.1.3.1<br>The student uses concrete and graphic models to derive formulas for finding perimeter, area, surface area, circumference, and volume of two- and three-dimensional shapes, including rectangular solids and cylinders.<br><br>*Expectations*<br>The student:<br><br>• Uses concrete or graphic models to create formulas for finding volumes for solids (prisms and cylinders).<br>• Uses concrete or graphic models to create formulas for finding surface area of prisms and cylinders.<br>• Solves and explains problems involving perimeter, area, and circumference.<br>• Solves and explains problems involving the surface area or volume of prisms and cylinders. | The student:<br><br>M2a is familiar with assorted two- and three-dimensional objects, including squares, triangles, other polygons, circles, cubes, rectangular prisms, pyramids, spheres, and cylinders.<br>M2c Identifies three dimensional shapes from two dimensional perspectives; draws two dimensional sketches of three dimensional objects that preserve significant features.<br>M2d Determine and understands length, area, and volume, including perimeter and surface area; uses units, square units, and cubic |

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| | MA.C.1.3.1<br>The student understands the basic properties of, and relationships pertaining to, regular and irregular geometric shapes in two and three dimensions.<br><br>*Expectations*<br>The student:<br><br>• Identifies, draws, and uses symbolic notation to denote the basic properties of geometric terms including lines (intersecting, skew, parallel, perpendicular) and congruent figures.<br>• Determine the measure of various types of angles using a protractor or angle relationships. (including complementary, supplementary, and vertical angles).<br>• Compares and describes the attributes of regular and irregular polygons.<br>• Identifies and classifies triangles and quadrilaterals.<br>• Knows the attributes of and draws here-dimensional figures.<br>• Knows the properties of two- and three-dimensional figures. | |

**Desired Results**

| Enduring Understanding | Essential Questions | Knowledge and Skills |
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| Students will understand<br><br>• Volume can be conceptualized as a measure of *filling* an object and surface area as a measure of *wrapping* an object. | • How can the concept of volume as the number of unit cubes be transferred to finding volumes of shapes that are not rectangular?<br>• What techniques can be used to relate the surface area of curved surfaces to familiar area concepts?<br>• How is the idea of wrapping an object related to the idea of surface area?<br>• How is the surface area of an object related to its volume?<br>• What techniques can be used to find the volume of an irregular figure? | Students will know<br>• Key terms (e.g., base, cone, cube, cylinder, edge, face, flat pattern, prism, rectangular prism, sphere, surface area, volume).<br><br>Students will be able to<br>• Calculate and estimate the surface area for three-dimensional figures.<br>• Calculate and estimate the volume of three-dimensional figures.<br>• Find the surface area and volume of rectangular prisms.<br>• Find the surface area and volume of cylinders, cones, and spheres.<br>• Estimate the surface area and volume of irregular three-dimensional figures. |

**Acceptable Evidence**

| Performance Tasks | Quizzes, Test, and Work Samples | Observations and Dialogues |
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| • **Building Boxes**<br>Students design flat patterns for cubic and rectangular boxes, cut them out, and fold them into boxes. The area of the flat pattern is associated with the surface area of the related box. The concept of volume is introduced by determining how many unit cubes it would take to fill particular boxes.<br>• **Designing Packages**<br>Students examine the amount of packaging material needed to | Check-Up 1<br>Quiz A<br>Check-Up 2<br>Quiz B<br>Unit Test | Teacher observations of students during work on performance tasks. Accountable talk during work on performance tasks. |

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|---|---|---|
| enclose various arrangements of 24 cubic blocks. In the process they find an arrangement that has the least surface area and generalize their finding to any number of blocks.<br>• **Finding Volumes of Boxes**<br>Students discover that the volume of a box is the number of blocks in the bottom layer multiplied by the number of layers – the area of the base items the height of the prism. Students develop a general strategy for finding the volume of any rectangular prism.<br>• **Cylinders**<br>Students find the volume and surface area of a cylinder by following the same process they used for prisms. The concept of the surface area of a cylinder is developed by having students cut out a flat pattern, think about what the dimensions and surface area of the cylinder made from the pattern will be, and then form the cylinder and determine its volume by finding how many unit cubes would fill it. | | |