Richmond Public Schools

Curriculum Framework

Grade 7 Honors (7/8)

Strand: Measurement and Geometry
8.6 The student will **a) solve problems, including practical problems, involving volume and surface area of cones and square-based pyramids; and** **b) describe how changing one measured attribute of a rectangular prism affects the volume and surface area.** **7.4 The student will** **a) describe and determine the volume and surface area of rectangular prisms and cylinders; and** **b) solve problems, including practical problems, involving the volume and surface area of rectangular prisms and cylinders.**
Suggested Pacing
Related Standards

Spiral Down: 5th Grade: • SOL 5.8a	Spiral Up: Geometry: • SOL G.13 (SOL8.6a) • SOL G.14b (SOL 8.6b)
Essential Questions	**Common Misconceptions**
• What are the ways we can solve for volume and surface area? • How do I use formulas to solve problems? • How can you use ratios to compare the surface areas and volumes of similar solids?	• Volume and Surface Area: deciding which numbers match with which variables; deciphering the picture • Triangular Pyramid and Prism: students struggle with the variables that have to be calculated (ie. B and p) • Order of Operations: students not strong with GEMDAS, will have difficulty simplifying the expression
Understanding the Standard	**Essential Knowledge and Skills**
SOL 8.6: • A polyhedron is a solid figure whose faces are all polygons.	SOL 8.6: • Distinguish between situations that are applications of surface area and those that are applications of volume. (a)

- Nets are two-dimensional representations of a three-dimensional figure that can be folded into a model of the three-dimensional figure.
- Surface area of a solid figure is the sum of the areas of the surfaces of the figure.
- Volume is the amount a container holds.
- A rectangular prism is a polyhedron that has a congruent pair of parallel rectangular bases and four faces that are rectangles. A rectangular prism has eight vertices and twelve edges. In this course, prisms are limited to right prisms with bases that are rectangles.
- The surface area of a rectangular prism is the sum of the areas of the faces and bases, found by using the formula $S.A. = 2lw + 2lh + 2wh.$ All six faces are rectangles.
- The volume of a rectangular prism is calculated by multiplying the length, width and height of the prism or by using the formula $V = lwh$.
- A cube is a rectangular prism with six congruent, square faces. All edges are the same length.
  A cube has eight vertices and twelve edges.
- A cone is a solid figure formed by a face called a base that is joined to a vertex (apex) by a curved surface. In this grade level, cones are limited to right circular cones.
- The surface area of a right circular cone is found by using the formula, $S.A. = \pi r^2 + \pi rl$, where l represents the slant height of the cone. The area of the base of a circular cone is πr^2.
- The volume of a cone is found by using $V = \frac{1}{3} \pi r^2 h$, where h is the height and πr^2 is the area of the base.
- A square-based pyramid is a polyhedron with a square base and four faces that are triangles with a common vertex (apex) above the base. In this grade level, pyramids are limited to right regular pyramids with a square base.

- Determine the surface area of cones and square-based pyramids by using concrete objects, nets, diagrams and formulas. (a)
- Determine the volume of cones and square-based pyramids, using concrete objects, diagrams, and formulas. (a)
- Solve practical problems involving volume and surface area of cones and square-based pyramids. (a)
- Describe how the volume of a rectangular prism is affected when one measured attribute is multiplied by a factor of $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, 2, 3, or 4. (b)
- Describe how the surface area of a rectangular prism is affected when one measured attribute is multiplied by a factor of $\frac{1}{2}$ or 2. (b)

SOL 7.4a,b:

- Determine the surface area of rectangular prisms and cylinders using concrete objects, nets, diagrams, and formulas. (a)
- Determine the volume of rectangular prisms and cylinders using concrete objects, diagrams, and formulas. (a)
- Determine if a practical problem involving a rectangular prism or cylinder represents the application of volume or surface area. (b)
- Solve practical problems that require determining the surface area of rectangular prisms and cylinders. (b)
- Solve practical problems that require determining the volume of rectangular prisms and cylinders. (b).

- The volume of a pyramid is $\frac{1}{3}Bh$, where B is the area of the base and h is the height.

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- The surface area of a pyramid is the sum of the areas of the triangular faces and the area of the base, found by using the formula $S.A. = \frac{1}{2}lp + B$ where l is the slant height, p is the perimeter of the base and B is the area of the base.
- The volume of a pyramid is found by using the formula $V = \frac{1}{3}Bh$, where B is the area of the base and h is the height.
- The volume of prisms can be found by determining the area of the base and multiplying that by the height.
- The formula for determining the volume of cones and cylinders are similar. For cones, you are determining $\frac{1}{3}$ of the volume of the cylinder with the same size base and height. The volume of a cone is found by using $V = \frac{1}{3}\pi r^2h$. The volume of a cylinder is the area of the base of the cylinder multiplied by the height, found by using the formula, $V = \pi r^2h$, where h is the height and πr^2 is the area of the base.
- The calculation of determining surface area and volume may vary depending upon the approximation for pi. Common approximations for π include 3.14, $\frac{22}{7}$, or the pi button on the calculator.
- When the measurement of one attribute of a rectangular prism is changed through multiplication or division the volume increases by the same factor by which the attribute increased. For example, if a prism has a volume of $2 \cdot 3 \cdot 4$, the volume is 24 cubic units. However, if one of the attributes is doubled, the volume doubles. That is, $2 \cdot 3 \cdot 8$, the volume is 48 cubic units or 24 doubled.
- When one attribute of a rectangular prism is changed through multiplication or division, the surface area is affected differently than the volume. The formula for surface area of a rectangular prism is $2(lw) + 2(lh) + 2(wh)$ when the width is doubled then four faces are affected. For example, a rectangular prism with length = 7 in., width = 4 in., and height = 3 in. would have a surface area of $2(7 \cdot 4) + 2(7 \cdot 3) + 2(4 \cdot 3)$ or 122

square inches. If the height is doubled to 6 inches then the surface area would be found by $2(7\cdot4) + 2(7\cdot6) + 2(4\cdot6)$ or 188 square inches. SOL 7.4a,b: ● A polyhedron is a solid figure whose faces are all polygons. ● A rectangular prism is a polyhedron in which all six faces are rectangles. A rectangular prism has eight vertices and 12 edges. ● A cylinder is a solid figure formed by two congruent parallel faces called bases joined by a curved surface. In this grade level, cylinders are limited to right circular cylinders. ● A face is any flat surface of a solid figure. ● The surface area of a prism is the sum of the areas of all 6 faces and is measured in square units. ● The volume of a three-dimensional figure is a measure of capacity and is measured in cubic units. ● Nets are two-dimensional representations of a three-dimensional figure that can be folded into a model of the three-dimensional figure. ● A rectangular prism can be represented on a flat surface as a net that contains six rectangles — two that have measures of the length and width of the base, two others that have measures of the length and height, and two others that have measures of the width and height. The surface area of a rectangular prism is the sum of the areas of all six faces $(SA = 2lw + 2lh + 2wh)$. ● A cylinder can be represented on a flat surface as a net that contains two circles (the bases of the cylinder) and one rectangular region (the curved surface of the cylinder) whose length is the circumference of the circular base and whose width is the height of the cylinder. The surface area of the cylinder is the sum of the area of the two circles and the rectangle representing the curved surface ($SA = 2\pi r^2 + 2\pi rh$). ● The volume of a rectangular prism is computed by multiplying the area of the base, B, (length times width) by the height of the prism ($V = lwh = Bh$).	

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- The volume of a cylinder is computed by multiplying the area of the base, B, (πr^2) by the height of the cylinder ($V = \pi r^2 h = Bh$).
- The calculation of determining surface area and volume may vary depending upon the approximation for pi. Common approximations for π include 3.14, $\frac{22}{7}$, or the pi button on the calculator.

Vocabulary

SOL 8.6:

Polyhedron	Volume	Surface-Area
Prism	Pyramid	Cube
Cone	Rectangular Prism	Square-Based Pyramid
Three-dimensional solid	Net	

SOL 7.4 a, b:

Rectangular Prism	Cylinder	Volume
Surface-Area	Face	

Assessment

Instructional Activities Organized by Learning Objective

Textbook

Notes

Resources

- Print
- Technology-based

Station Activities

Cross-Curricular Connections

Tiered Differentiations