

Lesson 2.2 – Volume and Surface Area

Definitions:

- Volume: The amount of space occupied by an object

Possible Units: $\frac{m^3}{ft^3}$

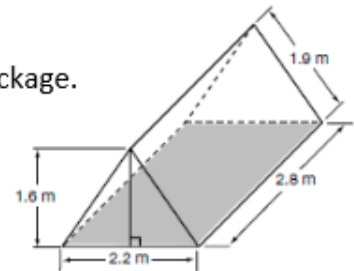
- Surface Area: The measure of the area of all the faces of an object.

Possible Units: $\frac{m^2}{ft^2}$

Example 1: Volume and Surface Area of a Prism

Determine the amount of chocolate that can fit inside this Toblerone package.

Determine the area of wrapper needed to cover the chocolate



SOLUTION:

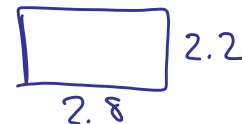
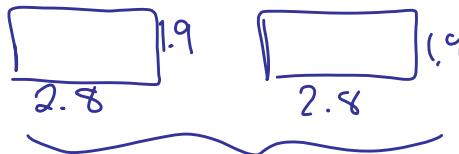
- Determine the shape Triangular Prism
- Calculate the volume:

- Formula for the volume: $V = \frac{bh}{2}l$

$$V = \frac{(2.2m)(2.8m)(1.6m)}{2}$$

$$= 4.928m^3$$

- Calculate the surface area:
 - Draw the sides of this shape separately (there are 5 sides):



- Calculate the area of each:

$$A_{\Delta} = \frac{2.2 \times 1.6}{2}$$

$$= \frac{3.52}{2}$$

$$= 1.76m^2$$

$$A_{\square} = 2.8 \times 1.9$$

$$= 5.32m^2$$

$$A_{\square} = 2.8 \times 2.2$$

$$= 6.16m^2$$

- Add up the areas:

$$\text{Surface Area} = 2(1.76) + 2(5.32) + 6.16$$

$$= 20.32m^2$$

Example 2: Volume of a Cylinder

Cineplex has just redesigned their popcorn containers. The container is 2ft high, and holds 1.5m^3 of popcorn. What is the diameter of the container, to the nearest centimeter?

Volume

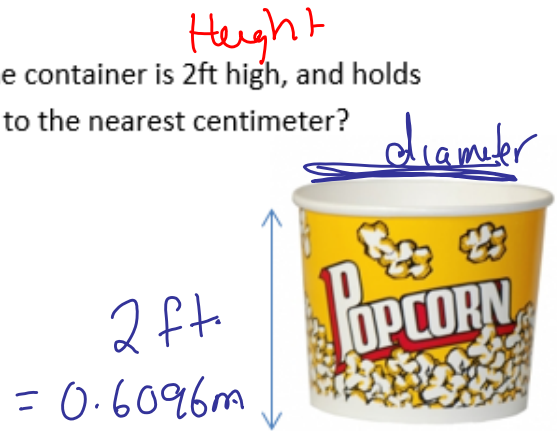
diameter

Solution:

Step 1: Convert the height to metres.

$$1\text{ft} = 0.3048\text{m}$$

$$2\text{ft} = 0.6096\text{m}$$



Step 2: Substitute the height and volume into the formula for the volume of a cylinder and solve for the radius.

Formula for the Volume of a Cylinder: $V = \pi r^2 h$

** 2radius = diameter*

$$1.5\text{m}^3 = \pi r^2 (0.6096\text{m})$$

$$\frac{1.5\text{m}^3}{0.6096\text{m}} = r^2 \left(\frac{1.915\text{m}}{1.915\text{m}} \right)$$

$$0.783\text{m}^2 = r^2$$

$$\sqrt{0.783\text{m}^2} = r$$

$$0.885\text{m} = r$$

$$\begin{aligned} d &= 2r \\ &= 2(0.885\text{m}) \\ &= 1.77\text{m} \end{aligned}$$

∴ The diameter is 1.77m.

Can you find the surface area of the popcorn bucket? (note: there is no top)

$$A_{\text{base}} = \pi r^2 \quad (\text{the bottom is a circle})$$

$$= \pi (0.885\text{m})^2$$

$$= 2.46\text{m}^2$$

$$A_{\text{side}} = 2\pi r h$$

$$= 2\pi (0.885\text{m})(0.6096\text{m})$$

$$= 3.39\text{m}^2$$

$$\begin{aligned} \text{Surface Area} &= 2.46\text{m}^2 + 3.39\text{m}^2 \\ &= 5.85\text{m}^2 \end{aligned}$$

∴ The surface area is 5.85m^2 .