

# Working with Composite Objects

## Learning Goals

- find surface area and volume of composite shapes

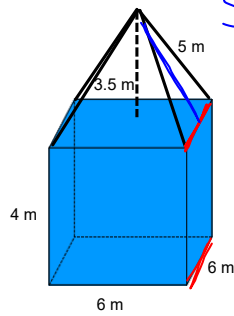
## Surface Area

- Outside area only
- Find area of all sides
- Add up all areas

## Volume

- Separate shapes
- Find volume of each
- Add up all the volumes

Find surface area and volume.

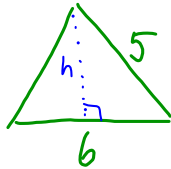


$$SA = 4 \triangle + 4 \square + 1 \square$$

$$= 4 \left( \frac{bh}{2} \right) + 4(lw) + (lw)$$

$$= 4 \left( \frac{6(4)}{2} \right) + 4(4 \cdot 6) + 6 \cdot 6$$

$$= 180 \text{ m}^2$$



$$a^2 + b^2 = c^2$$

$$h^2 + 3^2 = 5^2$$

$$h^2 + 9 = 25$$

$$h^2 = 16$$

$$h = 4$$

## Volume

$$V_{\square} = lwh$$

$$= 4 \cdot 6 \cdot 6$$

$$= 144 \text{ m}^3$$

$$V_{\triangle} = \frac{b^2 h}{3}$$

$$= \frac{6^2 (3.5)}{3}$$

$$= 42 \text{ m}^3$$

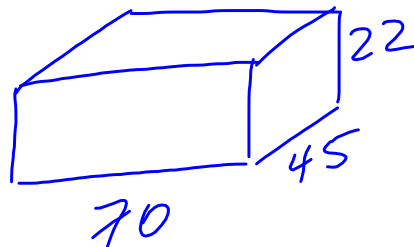
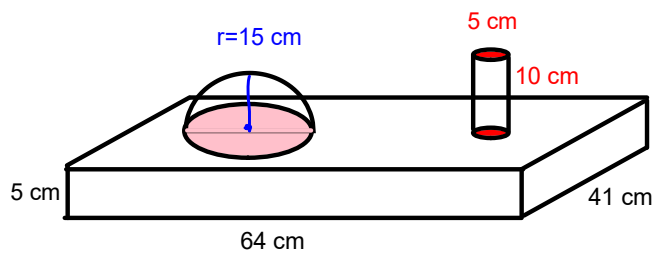
$$V_{\text{Total}} = 144 + 42$$

$$= 186 \text{ m}^3$$

A model made of fragile components has to be transported in a box. The box's dimension are 70x22x45 cm.

a. Determine if the object fits in the box or not

b. Find the volume of package peanuts needed to fill the empty space.



$$\begin{aligned} V_{\text{Box}} &= lwh \\ &= 70(22)(45) \\ &= 69300 \end{aligned}$$

$$\begin{aligned} V_{\text{box}} &= lwh \\ &= 64(41)(5) \\ &= 13120 \end{aligned}$$

$$\begin{aligned} V_{\text{c}} &= \pi r^2 h \\ &= (3.14)(2.5)^2(10) \\ &= 196.25 \end{aligned}$$

$$\begin{aligned} V_{\text{h}} &= \frac{4\pi r^3}{3} \div 2 \\ &= \frac{4(3.14)(15)^3}{3} \div 2 \\ &= 7065 \end{aligned}$$

$$\begin{aligned} V_{\text{all shapes}} &= 13120 + 196.25 \\ &\quad + 7065 \\ &= 20381.25 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} V_{\text{space}} &= V_{\text{Box}} - V_{\text{shape}} \\ &= 69300 - 20381.25 \\ &= 48918.75 \\ &\therefore 48918.75 \text{ cm}^3 \end{aligned}$$

**On the Boards...**

1. A fruit drink is sold in a box that contains 10 drink pouches. The dimensions of the box are shown.

- a) Determine the surface area of the cardboard used for the box.  
 b) Each drink pouch uses about  $340 \text{ cm}^2$  of material. How much is used for the 10 pouches?  
 c) Each drink pouch contains 200 mL. What is the total amount of drink in the package?



$$\begin{aligned} \text{a.) } SA &= 2(9(28.5) + 9(14.5) + (28.5)(14.5)) \\ &= 2(800.25) \\ &= 1600.5 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{b.) } &340(10) \\ &= 3400 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{c.) } &200(10) \\ &= 2000 \text{ mL} \\ &= 2 \text{ L} \end{aligned}$$

2. The bottom layer of the cake in part b of question 1 has length and width 14 inches and height 4 inches. The top layer has length and width 10 inches and height 4 inches. Assume that the entire top of the bottom layer is iced, but only the portion that can be seen is decorated.

- a) Determine the volume of each layer and the total volume of the two layers.  
 b) Determine the surface area that is iced.  
 c) Determine the area that is decorated.



$$\begin{aligned} \text{a.) } V_{\text{big}} &= 4(14)(14) \\ &= 784 \end{aligned}$$

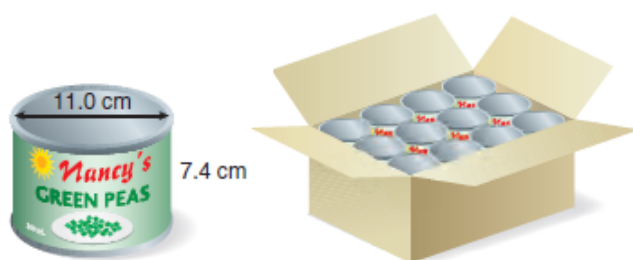
$$\begin{aligned} V_{\text{small}} &= 10(10)(4) \\ &= 400 \end{aligned}$$

$$\begin{aligned} V_{\text{Total}} &= 784 + 400 \\ &= 1184 \end{aligned} \quad \therefore 1184 \text{ in}^3$$

$$\begin{aligned}
 b.) \quad SA &= 10(10) + 4(4)(10) \rightarrow \text{small} \\
 &+ (14)(14) + 4(4)(14) \rightarrow \text{big} \\
 &= 680 \\
 &\quad \therefore 680 \text{ in}^2
 \end{aligned}$$

$$\begin{aligned}
 c.) \quad A_{\text{small}} &= 10(10) = 100 \\
 A_{\text{big}} &= 14(14) - 100 = 96 \\
 A_{\text{Total}} &= 100 + 96 \\
 &= 196 \\
 &\quad \therefore 196 \text{ in}^2
 \end{aligned}$$

3. A can of peas has a diameter of 11.0 cm and a height of 7.4 cm. The cans are packed for shipping in a box. They are arranged in 2 layers of 3 rows by 4. The box is constructed to fit the cans snugly. Determine the amount of empty space in the box.



$$V_{\text{box}} = 21489.6$$

$$V_{1 \text{ can}} = 702.889$$

$$V_{24 \text{ cans}} = 16869.336$$

$$V_{\text{space}} = 4620.264 \text{ cm}^3$$

# Homework

Finish question 3.