

5.9 Volume of a Sphere



Deriving the volume of a sphere.

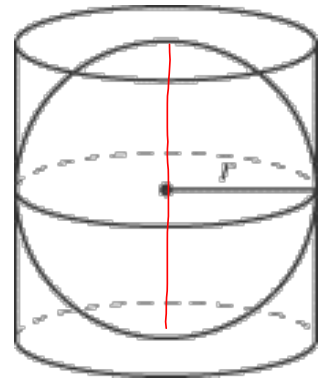
Volume of a sphere = $\frac{2}{3}$ Volume of a cylinder

$$V = \frac{2\pi r^2 h}{3}$$
$$= \frac{2\pi r^2 (2r)}{3}$$

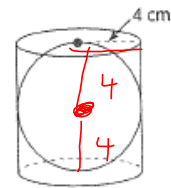
$$V = \frac{4\pi r^3}{3}$$

$$h = d$$
$$h = 2r$$

$$r^2 \cdot r^1$$
$$= r^3$$



Ex. 1: A solid rubber ball fits inside a can exactly.
The radius of the ball is 4 cm.



a) What is the volume of the can? Cylinder

$$\begin{aligned}
 V &= \pi r^2 h \\
 &= \pi (4)^2 (8) \\
 &= 402.1 \text{ cm}^3
 \end{aligned}$$

$r = 4$
 $h = 8$

b) What is the volume of the ball? Sphere

$$\begin{aligned}
 V_{\text{ball}} &= 402.1 \times \frac{2}{3} \\
 &= 268.1 \text{ cm}^3
 \end{aligned}$$

OR

$$\begin{aligned}
 V &= \frac{4\pi r^3}{3} \\
 &= \frac{4\pi (4)^3}{3} \\
 &= 268.1 \text{ cm}^3
 \end{aligned}$$

c) What is the volume of air in the can?

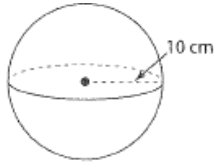
$$\begin{aligned}
 &V_{\text{cylinder}} - V_{\text{sphere}} \\
 &= 402.1 - 268.1 \\
 &= 134 \text{ cm}^3
 \end{aligned}$$

Formula:

$$V = \frac{4\pi r^3}{3}$$

Ex. 2: Determine the volume of each sphere:

a)



$$r = 10$$

$$\begin{aligned} V &= \frac{4\pi r^3}{3} \\ &= \frac{4\pi(10)^3}{3} \\ &= 4188.7 \text{ cm}^3 \end{aligned}$$

$$= 4456.$$

$$9 \text{ cm}^3$$

Buttons on your calculator:



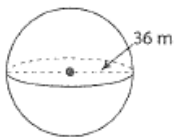
OR



OR



b)



$$d = 36$$

$$r = 18$$

$$\begin{aligned} V &= \frac{4\pi r^3}{3} \\ &= \frac{4\pi(18)^3}{3} \\ &= 24\,429.0 \text{ m}^3 \end{aligned}$$

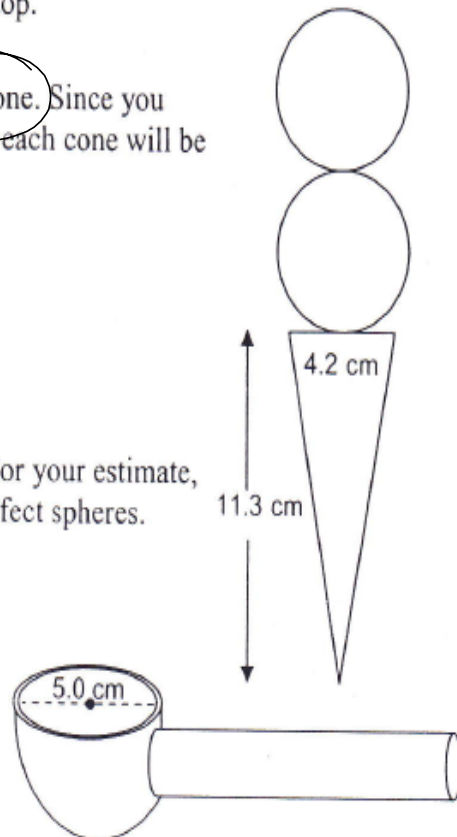
Practise: Volume of Cones and Spheres

You are helping to plan your sister's birthday party. She expects a total of 25 people at the party. Your job is to determine how much ice cream to buy so that everyone can have a full cone with two scoops on top.



1. First, determine how much ice cream will fit in each cone. Since you want to be sure to have enough ice cream, assume that each cone will be packed *full*!

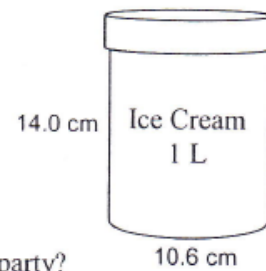
2. Next, estimate how much ice cream is in each scoop. For your estimate, assume that the scoop will shape the ice cream into perfect spheres.



3. a) What volume of ice cream do you need for each person?

b) What volume of ice cream do you need for 25 people?

4. a) Your favourite ice cream comes in this cylindrical container.
Show that this container can hold 1 L.



b) How many of these containers of ice cream do you need for the party?
(You cannot buy part of a container of ice cream.)

Homework
pg. 35 # 1, 3bc, 4b, 5, 6

