## Notes 9.6 Volume of Spheres

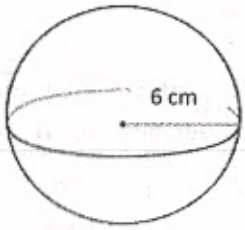
**Words** The volume, $V$, of a sphere is four thirds the product of $\pi$ and the cube of the radius, $r$.

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

**Model**


You can use the formula for the volume of a sphere to solve mathematical and real-world problems.

**Example 1: Find the volume of the sphere. Round to the nearest tenth.**




| | |
|---|---|
| $V = \frac{4}{3}\pi r^3$ | Volume of a sphere formula. |
| $V = \frac{4}{3} \cdot \pi \cdot 6^3$ | Substitute 6 in for r. |
| $V = \frac{4}{3} \cdot \pi \cdot (216)$ | Multiply $6^3$. |
| $V \approx 904.778$ | Multiply. |
| $V \approx 904.8\ cm^3$ | Round. |

**Try This: Find the volume of the sphere. Round to the nearest tenth.**

a.


$d = 16$ ft

$r = 8$ ft

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

$V = \frac{4}{3}\pi (8)^3$

$V = \frac{4}{3}\pi (512)$

$V \approx 2144.66$

$V \approx 2144.7\ ft^3$

**Example 2: A spherical stone in the courtyard of the National Museum of Costa Rica has a diameter of about 8 feet. Find the volume of the spherical stone. Round to the nearest tenth.**

$d = 8$ ft

$r = 4$ ft

| | |
|---|---|
| $V = \frac{4}{3}\pi r^3$ | Volume of a sphere formula. |
| $V = \frac{4}{3} \cdot \pi \cdot 4^3$ | Substitute 4 in for r. |
| $V = \frac{4}{3} \cdot \pi \cdot (64)$ | Multiply $4^3$. |
| $V \approx 268.0825$ | Multiply. |
| $V \approx 268.1\ ft^3$ | Round. |

The volume of the spherical stone is about 268.1 cubic feet.

**Try This:**

**b.** A dish contains a spherical scoop of vanilla ice cream with a radius of 1.2 inches. What is the volume of the ice cream? Round to the nearest tenth.

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

$V = \frac{4}{3}\pi (1.2)^3$

$V = \frac{4}{3}\pi (1.728)$

$V \approx 7.23$

$V \approx 7.2 \text{ in}^3$

**Example 3: A volleyball has a diameter of 10 inches. A pump can inflate the ball at a rate of 325 cubic inches per minute. How long will it take to inflate the ball? Round to the nearest tenth.**

Find the volume of the ball. Then use a proportion.

| | |
|---|---|
| $V = \frac{4}{3}\pi r^3$ | Volume of a sphere formula. |
| $V = \frac{4}{3} \cdot \pi \cdot 5^3$ | Substitute 5 in for r. |
| $V = \frac{4}{3} \cdot \pi \cdot (125)$ | Multiply $5^3$. |
| $V \approx 523.59$ | Multiply. |
| $V \approx 523.6$ | Round. |
| $\frac{325\ in^3}{1\ min} = \frac{523.6\ in^3}{x\ min}$ | Write the proportion. |
| $\frac{325x}{325} = \frac{523.6}{325}$ | Divide both sides by 325. |
| $x = 1.6$ | Simplify. |

It will take about 1.6 minutes to inflate the ball.

**Try This:**

**c.** A snowball has a diameter of 6 centimeters. How long would it take the snowball to melt if it melts at a rate of 1.8 cubic centimeters per minute? Round to the nearest tenth.

$d = 6\text{cm}$

$r = 3\text{cm}$

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

$V = \frac{4}{3}\pi (3)^3$

$V = \frac{4}{3}\pi (27)$

$V \approx 113.09$

$V \approx 113.1 \text{ cm}^3$

$\frac{1.8\ cm^3}{1\ min} = \frac{113.1\ cm^3}{x\ min}$

$1.8(x) = 1(113.1)$

$\frac{1.8x}{1.8} = \frac{113.1}{1.8}$

$x \approx 62.83$

$x \approx 62.8 \text{ mins}$

It will take about 62.8 minutes for the snowball to melt.

## Volume of a Hemisphere

A circle separates a sphere into two congruent halves each called a **hemisphere.**

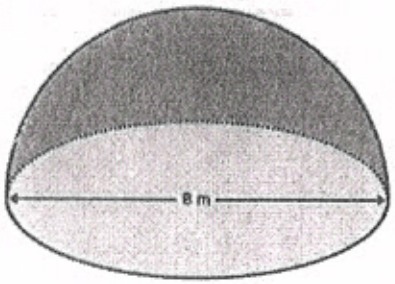
**Example 4: Find the volume of the hemisphere. Round to the nearest tenth.**


| | |
|---|---|
| $V = \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$ | Volume of a hemisphere formula. |
| $V = \frac{1}{2}\left(\frac{4}{3} \cdot \pi \cdot 3^3\right)$ | Substitute 3 for r. |
| $V = \frac{1}{2}\left(\frac{4}{3} \cdot \pi \cdot 27\right)$ | Multiply $3^3$. |
| $v \approx 56.548$ | Multiply. |
| $V \approx 56.5$ | Multiply. |

The volume is about 56.5 cubic inches.

**Try This: Find the volume of the hemisphere. Round to the nearest tenth.**

**d.**




$d = 8m$

$r = 4m$

$V = \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$

$V = \frac{1}{2}\left(\frac{4}{3}\pi (4)^3\right)$

$V = \frac{1}{2}\left(\frac{4}{3}\right)\pi (64)$

$V \approx 134.04$

$V \approx 134.0\ m^3$