

VOLUME OF SPHERES

LESSON 3-M



Find the volume of spheres and solve real-world problems involving spheres.

Many sports involve spheres. Baseballs, softballs, volleyballs, dodge balls, soccer balls, tennis balls and basketballs are all spheres. A **sphere** is a round, curved, closed three-dimensional solid. A sphere has no edges, sides or vertices. Every point on the surface of the sphere is an equal distance from the center of the sphere. This distance is the radius of the sphere.



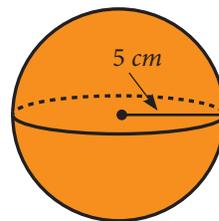
VOLUME OF A SPHERE

The volume of a sphere is equal to four-thirds the product of pi (π) and the cube of its radius (r^3).

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

EXAMPLE 1

Find the volume of the sphere. Use 3.14 for π .



SOLUTION

Write the volume formula for a sphere.

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

Substitute known values for the variables.

$$V \approx \frac{4}{3} (3.14)(5)^3$$

Find the value of the power.

$$V \approx \frac{4}{3} (3.14)(125)$$

Multiply.

$$V \approx 523.33$$

The volume of the sphere is about 523.33 cm^3 .

EXAMPLE 2

A water tower has a spherical tank. The diameter of the tank is 30 meters. How much water can the tank hold? Use 3.14 for π .

SOLUTION

Find the radius of the tank.

$$\text{Diameter} \div 2 = 30 \div 2 = 15$$

Write the volume formula for a sphere.

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

Substitute known values for the variables.

$$V \approx \frac{4}{3}(3.14)(15)^3$$

Find the value of the power.

$$V \approx \frac{4}{3}(3.14)(3375)$$

Multiply.

$$V \approx 14,130$$

The tank can hold approximately 14,130 cubic meters of water.

EXAMPLE 3

A bouncy ball has a volume of 113.04 cubic centimeters. Find the radius of the ball. Use 3.14 for π .

SOLUTION

Write the volume formula for a sphere.

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

Substitute known values for the variables.

$$113.04 \approx \frac{4}{3}(3.14)r^3$$

Multiply.

$$113.04 \approx 4.19r^3$$

Divide both sides of the equation by 4.19.

$$\frac{113.04}{4.19} \approx \frac{4.19r^3}{4.19}$$

$$27 \approx r^3$$

Cube root both sides of the equation.

$$\sqrt[3]{27} \approx \sqrt[3]{r^3}$$

Simplify.

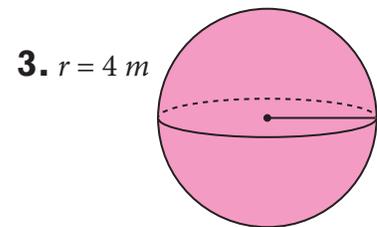
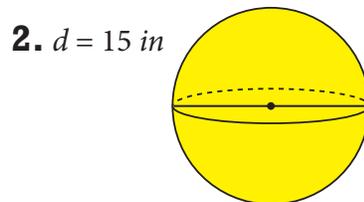
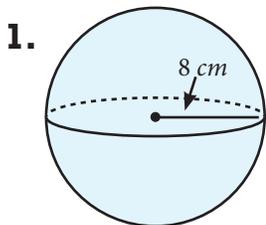
$$3 \approx r$$

This is a rounded answer. Rounding can make cubic roots easier to calculate.

The radius of the bouncy ball is close to 3 *cm*.

EXERCISES

Find the volume of each sphere. Use 3.14 for π . Round to the nearest hundredth.



4. A standard basketball used by professionals has a radius close to 12 *cm*. Find the approximate volume of a standard basketball.

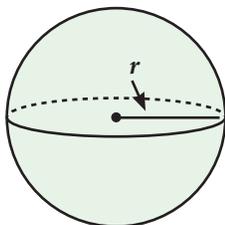
5. A spherical liquid soap container has a diameter of 5 in. How much soap can the container hold?
6. A bowl is shaped like a hemisphere, which is half of a sphere. The diameter of the bowl is 8 inches. How much water will the bowl hold?



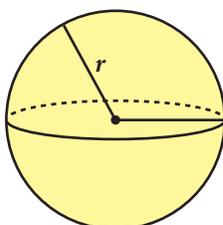
7. Karissa is having a party. She has a dozen balloons that are spheres when they are inflated. She wants to fill them with helium, but she does not know how much helium she needs to buy. The radius of each balloon is 6 inches when it is inflated properly.
- Calculate the volume of one balloon. Use 3.14 for π . Round to the nearest hundredth, as needed.
 - How much total helium will it take to fill all of the balloons?
 - If helium can only be purchased in whole number units, how much helium will Karissa need to buy?
8. Tennis balls are sold in sets of three inside a cylindrical can. Each tennis ball has a diameter of 2.5 inches. Assume the balls touch the can on the sides, top and bottom.
- Calculate the volume of one tennis ball.
 - Calculate the volume of the cylindrical can.
 - How many cubic inches are not used by the tennis balls inside the cylinder?

Find each missing measure. Use 3.14 for π .

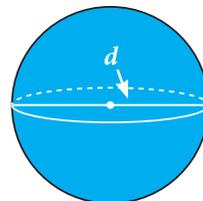
9. Volume $\approx 904.32 \text{ cm}^3$



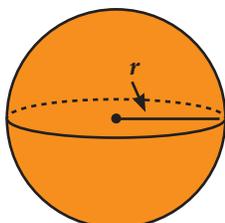
10. Volume $\approx 33.49 \text{ ft}^3$



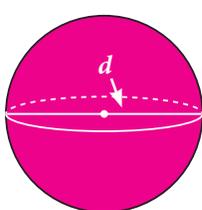
11. Volume $\approx 267.95 \text{ in}^3$



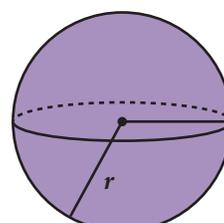
12. Volume $\approx 7234.56 \text{ m}^3$



13. Volume $\approx 523.33 \text{ yd}^3$



14. Volume $\approx 1436.03 \text{ in}^3$



15. A bouncy ball has a volume of 4.187 cubic inches. What is the diameter of the ball?

16. Graysen owns a world globe that has a volume of 3,052.08 cubic inches. What is the diameter of the globe?

17. A beach ball holds 800 cubic inches of air. What is the radius of the ball? Round to the nearest hundredth.



18. A spherical piece of candy has a chocolate outside with caramel in the middle. The diameter of the whole piece of candy is 3 centimeters. The diameter of the caramel filling is 2 centimeters.

- Find the volume of one whole piece of candy.
- Find the volume of the caramel center.
- What is the volume of chocolate used in each piece of candy?
- The candy comes in a package that states the volume of the candy is approximately 255 cubic centimeters. About how many pieces of candy are in the package?

19. A small beach ball has a radius of 10 inches. A larger beach ball has a volume that is twice the volume of the smaller ball. What is the radius of the large beach ball?

20. The equator is an imaginary line on the Earth's surface which divides the Earth into two equal hemispheres. It is approximately 24,901.55 miles long. Assume the earth is perfectly round and use the length of the equator to find the volume of the earth.



21. Abigail shipped a globe to her sister. The globe fit snugly in a box, touching the sides, bottom and top. The globe has a volume of 1,436 cubic inches. Find the volume of the box.