Name _____ Date _____

LESSON 11.8

LESSON 11.8 Study Guide

For use with the lesson "Surface Area and Volume of Spheres"

GOAL **Find surface areas and volume of spheres.**

Vocabulary

A **sphere** is the set of all points in space equidistant from a given point. This point is called the **center** of the sphere.

A **radius** of a sphere is a segment from the center to a point on the sphere.

A **chord** of a sphere is a segment whose endpoints are on the sphere.

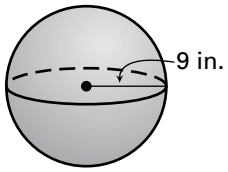
A **diameter** of a sphere is a chord that contains the center.

Theorem 11 Surface Area of a Sphere: The surface area S of a sphere is $S = 4\pi r^2$, where r is the radius of the sphere.

Theorem 12 Volume of a Sphere: The volume V of a sphere is $V = \frac{4}{3}\pi r^3$, where r is the radius of the sphere.

EXAMPLE 1 Find the surface area of a sphere

Find the surface area of the sphere.



Solution

$S = 4\pi r^2$ Formula for surface area of a sphere

$= 4\pi(9)^2 = 324\pi \approx 1017.88$ Substitute 9 for r and simplify.

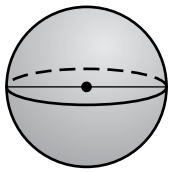
The surface area of the sphere is about 1017.88 square inches.

EXAMPLE 2 Standardized Test Practice

The surface area of the sphere is 12.25π square centimeters. What is the diameter of the sphere?

A 12.25 cm B 1.75 cm

C 3.5 cm D 5.5 cm



$S = 12.25\pi$ cm^2

Solution

$S = 4\pi r^2$ Formula for surface area of a sphere

$12.25\pi = 4\pi r^2$ Substitute 20.25π for S.

$3.0625 = r^2$ Divide each side by 4π.

$1.75 = r$ Find the positive square root.

The diameter of the sphere is $2r = 2(1.75) = 3.5$ cm. The correct answer is C.

LESSON 11.8

Study Guide *continued*

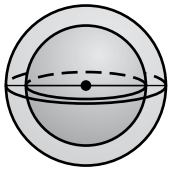
For use with the lesson "Surface Area and Volume of Spheres"

Exercises for Examples 1 and 2

1. The diameter of a sphere is 50 feet. Find the surface area of the sphere.
2. The surface area of a sphere is 36π square meters. Find the radius of the sphere.

EXAMPLE 3 Use the circumference of a sphere

In the diagram, the circumference of the outer ball is 8π feet. Find the surface area of the outer ball.



Solution

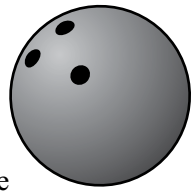
$C = 2\pi r$	Formula for circumference
$8\pi = 2\pi r$	Substitute 8π for C.
$4 = r$	Divide each side by 2π.

$S = 4\pi r^2 = 4\pi(4)^2 = 64\pi \approx 201.06$

The surface area of the outer ball is 64π, or about 201.06 square feet.

EXAMPLE 4 Find the volume of a sphere

The bowling ball has a diameter of 8 inches. Find its volume.



Solution

$V = \frac{4}{3}\pi r^3$	Formula for volume of a sphere
$V = \frac{4}{3}\pi(4)^3 = \frac{256}{3}\pi \approx 268.08$	Substitute $\frac{8}{2}$, or 4, for r and simplify.

The volume of the bowling ball is $\frac{256}{3}\pi$, or about 268.08 cubic inches.

Exercises for Examples 3 and 4

3. In Example 3, the circumference of the inner ball is 5π feet. Find the surface area of the inner ball. Round your answer to two decimal places.
4. The radius of a sphere is 7 yards. Find the volume of the sphere. Round your answer to two decimal places.

Lesson 11.8 Surface Area and Volume of Spheres

Teaching Guide

1. volume: about 5,276,669,286 cubic miles; surface area: about 14,657,415 square miles

2. about 3963 miles **3.** about 197,359,488 square miles **4.** Earth's surface area is about 13.5 times the size of the moon's surface area.

5. about 77.2%

Practice Level A

1. T **2.** *Sample answer:* $\overline{QR}$

3. *Sample answer:* $\overline{ST}$ **4.** $\overline{PS}$ **5.** 14π m

6. 452.39 cm^2 **7.** 4536.46 ft^2 **8.** 1520.53 $in.^2$

9. 78.54 m^2 **10.** 706.86 yd^2 **11.** 11,309.73 cm^2

12. hemisphere **13.** 8.5 ft **14.** 17 ft

15. 453.96 ft^2 **16.** 9 cm **17.** 1 ft **18.** 6.4 m

19. 358,908.11 m^2 **20.** 523.6 m^3

21. 11,494.04 $in.^3$ **22.** 113.1 ft^3 **23.** 381.7 cm^3

24. 4849.05 yd^3 **25.** 91,952.32 m^3 **26.** 12 yd

27. 3 in. **28.** 2 mm

29. $S = 12.57$ m^2, $V = 4.19$ m^3

30. 2.5 ft **31.** 15.71 ft **32.** 65.45 ft^3

33. The surface area of Pluto is about $\frac{1}{30}$ of Earth's surface area.

Practice Level B

1. 201.06 cm^2 **2.** 28.27 $in.^2$ **3.** 615.75 m^2

4. B **5.** $\frac{7}{2}$ cm **6.** 7 cm **7.** 76.97 cm^2

8. 1901.17 m^2 **9.** 1436.76 ft^3 **10.** 381.7 yd^3

11. 2144.66 m^3 **12.** 2.48 in. **13.** 4.83 cm

14. 3.31 m **15.** B **16.** 490.09 cm^2; 904.78 cm^3

17. 254.47 $in.^2$; 197.92 $in.^3$ **18.** 566.01 ft^2; 1093.27 ft^3 **19.** 24π mm; 576π mm^2; 2304π mm^3

20. 4 in.; 64π $in.^2$; $\frac{256}{3}\pi$ $in.^3$

21. $\frac{7}{2}$ ft; 7π ft; $\frac{343}{6}\pi$ ft^3

22. 6 m; 12π m; 144π m^2 **23.** 18 cm

24. 8.87 $in.^2$ **25.** 2.48 $in.^3$ **26.** 9.04 $in.^3$

Practice Level C

1. 172.03 m^2 **2.** 2.01 mi^2 **3.** 79,422.6 mm^2

4. 415.48 cm^2 **5.** 226.19 $in.^2$ **6.** 62.83 ft^2

7. 2.1 m **8.** 9.75 cm **9.** 0.6 ft **10.** 80π cm^2

11. 2352.07 cm^3 **12.** 606.13 ft^3

13. 124,185.41 $in.^3$ **14.** 10.31 m^3 **15.** 21.77 mm^3

16. 219.42 yd^3 **17.** $S = 104.72$ m^2, $V = 77.57$ m^3

18. $S = 1009.61$ ft^2, $V = 2322.09$ ft^3

19. $S = 6597.34$ cm^2, $V = 38{,}788.74$ cm^3

20. π cm^2 **21.** 16π $in.^2$ **22.** 16π m^2

23. 58.43 ft, 1086.87 ft^2, 3369.28 ft^3

24. 13.45 m, 2273.29 m^2, 10,191.91 m^3

25. 29 yd, 182.21 yd, 102,160.4 yd^3

26. 11 cm, 69.12 cm, 1520.53 cm^2

27. $S \approx 27{,}646$ ft^2, $V \approx 385{,}368.7$ ft^3

28. about 52 cm^3

Study Guide

1. 7853.98 ft^2 **2.** 3 m **3.** 78.54 ft^2

4. 1436.76 yd^3

Real-Life Application

1. radius $\approx$ 31.72 ft; diameter $\approx$ 63.44 ft; circumference $\approx$ 199.30 ft **2.** about 12,643.76 ft^2

3. Radius is approximately 25.18 feet; about 20% reduction in radius compared to a 50% reduction in volume.

Challenge Practice

1. $\frac{s}{r} = \sqrt[3]{4\pi}$ **2.** $\frac{r_c}{r_s} = \sqrt{\frac{8}{h}} = \frac{2\sqrt{2}}{\sqrt{h}}$

3. a. $V = \frac{16}{3}\pi r^3$ **b.** $r > 0$

c. Radius: 1.9 ft; length: 7.6 ft

4. $(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2 = r^2$

5. $(x + 4)^2 + (y - 3)^2 + (z - 5)^2 = 81$

6. $\left(x - \frac{5}{2}\right)^2 + (y - 1)^2 + z^2 = \frac{97}{4}$

7. $V = \frac{4}{3}\pi abc$ **8.** $1120\pi \approx 3518.6$ cm^3

Lesson 11.9 Explore Similar Solids

Teaching Guide

1. Two polygons are similar if all corresponding angles are congruent and all corresponding side lengths are proportional.

2. Yes, because all angles are 90° and $\frac{a}{b} = \frac{a}{b} = \frac{a}{b}$.

3. Check student's drawings: