Volume of Cones and Spheres

Name: _____	Date: _____	Score: _____ / 24

Quick Review

Two more volume formulas worth knowing by heart. A **cone** has volume $V = \frac{1}{3}\pi r^2 h$ — one third of a cylinder with the same radius and height. A **sphere** has volume $V = \frac{4}{3}\pi r^3$. In both, r is the *radius*, so halve the diameter if that's what you're given, and remember to *cube* the radius for a sphere but only *square* it for a cone. Leave π in your answer for an exact value, or use $\pi \approx 3.14$ when asked for a decimal. Volume is always in *cubic* units.

◇ **Example:** Find the volume of a sphere with radius 3 in. Leave your answer in terms of π.
⇒ The sphere volume formula is $V = \frac{4}{3}\pi r^3$. The radius is 3, so cube it first: $3^3 = 27$. Now multiply by $\frac{4}{3}$: $\frac{4}{3} \times 27 = \frac{108}{3} = 36$. So the volume is 36π cubic inches. Keeping π gives the exact answer.

Answer: $V = 36\pi$ in^3

PRACTICE

Find each volume. Leave answers in terms of π unless noted.

1. Cone: $r = 3,\ h = 9$ _____
2. Cone: $r = 6,\ h = 10$ _____
3. Cone: $r = 5,\ h = 12$ _____
4. Cone: $r = 2,\ h = 6$ _____
5. Cone: $r = 9,\ h = 4$ _____
6. Cone: $r = 4,\ h = 3$ _____
7. Cone: $r = 3,\ h = 7$ _____
8. Cone: $r = 10,\ h = 9$ _____
9. Cone: $d = 6,\ h = 10$ _____
10. Sphere: $r = 3$ _____
11. Sphere: $r = 6$ _____
12. Sphere: $r = 9$ _____
13. Sphere: $r = 2$ _____
14. Sphere: $r = 12$ _____
15. Sphere: $r = 1$ _____
16. Sphere: $d = 12$ _____
17. Sphere: $d = 6$ _____
18. Cone: $r = 5,\ h = 6$ _____
19. Cone: $r = 3,\ h = 10,$ use $\pi \approx 3.14$ _____
20. Sphere: $r = 3,$ use $\pi \approx 3.14$ _____

♦ Word Problems

21. A party hat is shaped like a cone with radius 5 cm and height 12 cm. What is its volume in terms of π? _____
22. A bowling ball is a sphere with radius 6 in. Find its volume in terms of π. _____
23. A cone-shaped paper cup has radius 3 cm and height 10 cm. Using $\pi \approx 3.14$, how much water does it hold, to the nearest tenth? _____
24. A cone and a sphere both have radius 6 cm, and the cone's height is also 6 cm. Which holds more, and by how much? Leave answers in terms of π. _____

Answer Keys

1. 27π
2. 120π
3. 100π
4. 8π
5. 108π
6. 16π
7. 21π
8. 300π
9. 30π
10. 36π
11. 288π
12. 972π
13. $\frac{32}{3}\pi$
14. 2304π
15. $\frac{4}{3}\pi$
16. 288π
17. 36π
18. 50π
19. 94.2
20. 113.04
21. 100π cm^3
22. 288π in^3
23. 94.2 cm^3
24. The sphere; it holds 216π cm^3 more

Step-by-Step Explanations

1. $V = \frac{1}{3}\pi(9)(9) = 27\pi$.
2. $V = \frac{1}{3}\pi(36)(10) = 120\pi$.
3. $V = \frac{1}{3}\pi(25)(12) = 100\pi$.
4. $V = \frac{1}{3}\pi(4)(6) = 8\pi$.
5. $V = \frac{1}{3}\pi(81)(4) = 108\pi$.
6. $V = \frac{1}{3}\pi(16)(3) = 16\pi$.
7. $V = \frac{1}{3}\pi(9)(7) = 21\pi$.
8. $V = \frac{1}{3}\pi(100)(9) = 300\pi$.
9. Radius is 3: $V = \frac{1}{3}\pi(9)(10) = 30\pi$.
10. $V = \frac{4}{3}\pi(27) = 36\pi$.
11. $V = \frac{4}{3}\pi(216) = 288\pi$.
12. $V = \frac{4}{3}\pi(729) = 972\pi$.
13. $V = \frac{4}{3}\pi(8) = \frac{32}{3}\pi$.
14. $V = \frac{4}{3}\pi(1728) = 2304\pi$.
15. $V = \frac{4}{3}\pi(1) = \frac{4}{3}\pi$.
16. Radius is 6: $V = \frac{4}{3}\pi(216) = 288\pi$.
17. Radius is 3: $V = \frac{4}{3}\pi(27) = 36\pi$.
18. $V = \frac{1}{3}\pi(25)(6) = 50\pi$.
19. $V = \frac{1}{3}(3.14)(9)(10) = 94.2$.
20. $V = \frac{4}{3}(3.14)(27) = 113.04$.
21. $V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(25)(12) = \frac{1}{3}\pi(300) = 100\pi$ cubic centimeters.
22. $V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(6^3) = \frac{4}{3}\pi(216) = 288\pi$ cubic inches.
23. $V = \frac{1}{3}\pi r^2 h \approx \frac{1}{3}(3.14)(9)(10) = \frac{1}{3}(282.6) = 94.2$ cubic centimeters.
24. Cone: $V = \frac{1}{3}\pi(36)(6) = 72\pi$ cm^3. Sphere: $V = \frac{4}{3}\pi(216) = 288\pi$ cm^3. The sphere holds $288\pi - 72\pi = 216\pi$ cm^3 more.

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