

Chapter 6 Volume of Prisms and Cylinders

Teacher Guide and Diagnostic Answer Key

Teacher Guide

Teacher Chapter-at-a-Glance

A transparent container or stack-of-layers model is helpful
Pacing
Talk Prompt

Mastery Decision Guide

A missed Tripwire does not automatically mean “redo the chapter.” Confirm the likely misconception, reteach the smallest prerequisite or representation that addresses it, and then use a fresh item before moving on.

Missed Tripwire #1 → Diameter is being used as radius. Next move: Convert diameter to radius before writing the volume substitution.

Diagram Production Notes — Chapter 6

Use the diagram master IDs:

Ch17-D01 — Cubic Unit

Ch17-D02 — Volume as Layers

Ch17-D03 — Rectangular Prism Volume

Ch17-D04 — Cube Volume

Ch17-D05 — Triangular Prism Volume

Ch17-D06 — Cylinder Volume

Ch17-D07 — Diameter to Radius in Volume

Ch17-D08 — Surface Area vs Volume

The volume-as-layers diagram should show equal layers stacked clearly. The triangular prism diagram must distinguish the perpendicular height of the triangular base from the length of the prism. The cylinder diagram must label radius, height, and circular base area clearly. The surface-area-versus-volume trap should contrast outside covering with inside filling.

Confirmation and Fresh Recheck

Likely evidence: Using $r=10$ and getting a value four times too large.

Possible interpretation: Diameter is being used as radius.

Confirm with: Ask the student to identify one base layer B and the perpendicular stacking height, then state the unit dimension.

Targeted repair: Convert diameter to radius before writing the volume substitution.

Fresh recheck: Use a cylinder with diameter given and a triangular prism with base area given; require cubic units.

Ready to Learn Check

Quick check before starting. A wrong response below points to a prerequisite worth confirming before the chapter builds on it.

1. What does volume measure?

Correct answer: Space inside a solid.

Likely wrong answer: Outside covering.

Possible misconception: Volume and surface area are being confused.

Next move: Use a fill-versus-wrap comparison.

2. What unit should volume use: cm, cm², or cm³?

Correct answer: cm³

Likely wrong answer: cm²

Possible misconception: Volume units are not secure.

Next move: Build a 1 cm × 1 cm × 1 cm cube and name one cubic centimetre.

3. What is the area of a rectangle that is 6 cm by 4 cm?

Correct answer: 24 cm²

Likely wrong answer: 20 cm or 10 cm²

Possible misconception: Base area is not secure.

Next move: Find one layer first: 6 × 4.

4. What is the area of a circle with radius 5 cm?

Correct answer: Radius.

Likely wrong answer: Diameter.

Possible misconception: Cylinder formulas are being used without identifying r.

Next move: Label r before substituting into $\pi r^2 h$.

Ready-to-Learn item 1

Correct answer: Space inside a solid.

Likely wrong answer: Outside covering.

Misconception: Volume and surface area are being confused.

Next move: Use a fill-versus-wrap comparison.

Ready-to-Learn item 2

Correct answer: cm^3

Likely wrong answer: cm^2

Misconception: Volume units are not secure.

Next move: Build a $1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm}$ cube and name one cubic centimetre.

Ready-to-Learn item 3

Correct answer: 24 cm^2

Likely wrong answer: 20 cm or 10 cm^2

Misconception: Base area is not secure.

Next move: Find one layer first: 6×4 .

Ready-to-Learn item 4

Correct answer: Radius.

Likely wrong answer: Diameter.

Misconception: Cylinder formulas are being used without identifying r .

Next move: Label r before substituting into $\pi r^2 h$.

Practice

Assign the full set or select items for targeted review. Teacher solutions follow each question.

1. rectangular prism: 4 cm by 3 cm by 2 cm

Solution: 1. $V = 4 \times 3 \times 2 = 24 \text{ cm}^3$

2. rectangular prism: 8 m by 6 m by 5 m

Solution: 2. $V = 8 \times 6 \times 5 = 240 \text{ m}^3$

3. cube with side length 5 cm

Solution: 3. $V = 5^3 = 5 \times 5 \times 5 = 125 \text{ cm}^3$

4. cube with side length 2.5 m Find the volume.

Solution: 4. $V = 2.5^3 = 2.5 \times 2.5 \times 2.5 = 15.625$

5. triangular base: base 6 cm, perpendicular height 4 cm; prism length 10 cm

Solution: 5. $A = (6 \times 4) \div 2 = 12$ $V = 12 \times 10 = 120 \text{ cm}^3$

6. triangular base: base 8 m, perpendicular height 5 m; prism length 12 m

Solution: 6. $A = (8 \times 5) \div 2 = 20$ $V = 20 \times 12 = 240 \text{ m}^3$

7. triangular base area 18 cm^2 ; prism length 9 cm Find the volume.

Solution: 7. $V = 18 \times 9 = 162 \text{ cm}^3$

8. radius 3 cm, height 7 cm

Solution: 8. $V = 3.14 \times 3^2 \times 7 = 197.82$

9. radius 5 m, height 10 m

Solution: 9. $V = 3.14 \times 5^2 \times 10 = 785 \text{ m}^3$

10. diameter 12 cm, height 8 cm

Solution: 10. $r = 12 \div 2 = 6$ $V = 3.14 \times 6^2 \times 8 = 904.32$

11. diameter 20 m, height 4 m Write the measurement needed.

Solution: 11. $r = 20 \div 2 = 10$ $V = 3.14 \times 10^2 \times 4 = 1256 \text{ m}^3$

12. filling a fish tank with water

Solution: 12. volume

13. painting the outside of a cylinder

Solution: 13. surface area

14. finding how much cereal fits in a box

Solution: 14. volume

15. wrapping a rectangular gift box

Solution: 15. surface area

16. finding how much concrete fills a rectangular mold

Solution: 16. volume

17. A student gives a volume answer in cm^2 . Explain the mistake.

Solution: 17. Volume uses cubic units because it measures 3-D space. The correct unit is cm^3 , not cm^2 .

18. A student uses $V = 2\pi r^2 + 2\pi rh$ for a cylinder being filled. Explain the mistake.

Solution: 18. $2\pi r^2 + 2\pi rh$ finds surface area of a closed cylinder. A cylinder being filled needs volume: πr^2h .

19. A cylinder has diameter 16 cm. A student uses 16 cm as the radius. Explain the mistake.

Solution: 19. Diameter is the full distance across the circle. Radius is half the diameter, so the radius is 8 cm.

20. A triangular prism has a triangular base with base 10 cm and perpendicular height 6 cm. A student finds the base area as $10 \times 6 = 60$. Explain the mistake.

Solution: 20. The student forgot to divide by 2. A triangle's area is $(b \times h) \div (2)$, so the base area is $(10 \times 6) \div (2) = 30 \text{ cm}^2$.

Chapter Answer Key

Tripwire Check

The student is not correct.

The formula uses radius, not diameter.

$$r = 16 \div 2$$

$$r = 8$$

Now find the volume:

$$V = \pi r^2 h$$

$$V = 3.14 \times 8^2 \times 5$$

$$V = 3.14 \times 64 \times 5$$

$$V = 200.96 \times 5$$

$$V = 1004.8$$

The correct volume is:

$$1004.8 \text{ cm}^3$$

Worksheet 1: Guided Practice

1.

The correct unit is:

$$\text{cm}^3$$

2.

$$V = 72$$

Volume:

$$72 \text{ cm}^3$$

3.

$$V = 125$$

Volume:

$$125 \text{ m}^3$$

4.

$$r = 6$$

Worksheet 2: Independent Practice

1.

a.

$$V = 5 \times 4 \times 3 = 60$$

$$60 \text{ cm}^3$$

b.

$$V = 10 \times 6 \times 2 = 120$$

$$120 \text{ m}^3$$

c.

$$V = 12 \times 5 \times 4 = 240$$

$$240 \text{ cm}^3$$

d.

$$V = 7 \times 7 \times 3 = 147$$

$$147 \text{ m}^3$$

2.

a.

$$V = 3^3 = 27$$

$$27 \text{ cm}^3$$

b.

$$V = 6^3 = 216$$

$$216 \text{ m}^3$$

c.

$$V = 10^3 = 1000$$

$$1000 \text{ cm}^3$$

d.

$$V = 1.5^3 = 3.375$$

$$3.375 \text{ m}^3$$

3.

a.

$$A = 6 \times 4 = 24 \div 2 = 12$$

$$V = 12 \times 8 = 96$$

$$96 \text{ cm}^3$$

b.

$$A = 10 \times 6 = 60 \div 2 = 30$$

$$V = 30 \times 12 = 360$$

$$360 \text{ m}^3$$

c.

$$V = 24 \times 9 = 216$$

$$216 \text{ cm}^3$$

4.

a.

$$V = 3.14 \times 2^2 \times 9$$

$$V = 3.14 \times 4 \times 9$$

$$V = 113.04$$

$$113.04 \text{ cm}^3$$

b.

$$V = 3.14 \times 4^2 \times 5$$

$$V = 3.14 \times 16 \times 5$$

$$V = 251.2$$

$$251.2 \text{ m}^3$$

c.

$$r = 8 \div 2 = 4$$

$$V = 3.14 \times 4^2 \times 10$$

$$V = 3.14 \times 16 \times 10$$

$$V = 502.4$$

$$502.4 \text{ cm}^3$$

d.

$$r = 14 \div 2 = 7$$

$$V = 3.14 \times 7^2 \times 6$$

$$V = 3.14 \times 49 \times 6$$

$$V = 923.16$$

$$923.16 \text{ m}^3$$

Worksheet 3: Mixed Practice & Application

1.

a. Volume is needed because the question asks about space inside.

b.

$$V = 14 \times 9 \times 6$$

$$V = 756$$

$$756 \text{ cm}^3$$

2.

$$V = 2 \times 1.5 \times 0.4$$

$$V = 3 \times 0.4$$

$$V = 1.2$$

The volume of concrete needed is:

$$1.2 \text{ m}^3$$

3.

Area of triangular base:

$$A = (12 \times 5) \div 2$$

$$A = 60 \div 2$$

$$A = 30$$

Volume:

$$V = 30 \times 20$$

$$V = 600$$

The volume is:

$$600 \text{ cm}^3$$

4.

a.

$$r = 18 \div 2 = 9$$

b.

$$V = 3.14 \times 9^2 \times 10$$

$$V = 3.14 \times 81 \times 10$$

$$V = 254.34 \times 10$$

$$V = 2543.4$$

The volume is:

$$2543.4 \text{ m}^3$$

5.

The student used diameter as radius.

The radius is:

$$r = 16 \div 2 = 8$$

Correct volume:

$$V = 3.14 \times 8^2 \times 7$$

$$V = 3.14 \times 64 \times 7$$

$$V = 200.96 \times 7$$

$$V = 1406.72$$

The volume is:

$$1406.72 \text{ cm}^3$$

6.

a.

$$V = 10 \times 6 \times 4 = 240$$

$$240 \text{ cm}^3$$

b.

$$SA = 2(10 \times 6) + 2(10 \times 4) + 2(6 \times 4)$$

$$SA = 120 + 80 + 48$$

$$SA = 248$$

$$248 \text{ cm}^2$$

c. Volume measures inside space, so it uses cubic units. Surface area measures outside covering, so it uses square units.

Diagnostic Key — High-Leverage Items

Tripwire Check

Correct answer: No. Diameter 10 cm gives $r=5$ cm. $V=\pi r^2 h \approx 3.14 \times 25 \times 6 = 471 \text{ cm}^3$.

Likely wrong answer: Using $r=10$ and getting a value four times too large.

Misconception: Diameter is being used as radius.

Next move: Convert diameter to radius before writing the volume substitution.

Tripwire Diagnostic

Correct answer: No. Diameter 16 cm gives $r=8$ cm. $V=\pi r^2 h \approx 3.14 \times 64 \times 5 = 1004.8 \text{ cm}^3$.

Likely wrong answer: Using $r=16$ and getting a value four times too large.

Misconception: Diameter is being used as radius.

Next move: Convert diameter to radius before writing the volume substitution.

Exit Ticket Diagnostic — High-Leverage Item

Correct answer: 226.08 cm^3 .

Likely wrong answer: 28.26 cm^2 or 75.36 cm^3

Misconception: The student found only the circular base area or did not multiply by the cylinder height.

Next move: Use $V=Bh$: first find πr^2 , then multiply by h and use cubic units.

Variation Lab — Expected Ideas

1. With fixed base area B , volume varies directly with perpendicular height: $V=Bh$.
2. Prism and cylinder share $V=Bh$; only the base-area expression changes.
3. Using diameter as radius makes r^2 four times too large, so volume becomes four times too large.

Transfer Check — Suggested Responses

Familiar: 120 cm^3 . Altered: 216 cm^3 . Non-routine: $r=5$; $V=3.14 \times 25 \times 6 = 471 \text{ cm}^3$. Repair: $V=240 \text{ cm}^3$; volume uses cubic units.

Exit Ticket — Answers

1. 120 cm^3
2. 226.08 cm^3
3. Volume counts 3-D space, so cubic units are required.