

Chapter 4 Surface Area of Prisms

Teacher Guide and Diagnostic Answer Key

Teacher Guide

Teacher Chapter-at-a-Glance

A box and a net are 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 → A volume procedure is being used for an outside-covering question. Next move: Unfold/picture the six faces and add their areas; ask “wrap or fill?” before selecting a method.

Confirmation and Fresh Recheck

Confirm with: Ask, “If I wrap or paint this solid, which faces can I actually touch from the outside?”

Fresh recheck: Use an open-top prism with different dimensions and require a face list before calculation.

Decision rule: Move forward only when the fresh response is secure and the reasoning survives the changed representation or context.

Diagram Production Notes — Chapter 4

Use the diagram master IDs:

Ch15-D01 — Surface Area as Outside Covering

Ch15-D02 — Rectangular Prism Face Pairs

Ch15-D03 — Rectangular Prism Net

Ch15-D04 — Cube Net

Ch15-D05 — Triangular Prism Net

Ch15-D06 — Visible Faces Trap

Ch15-D07 — Open-Top Box

Ch15-D08 — Surface Area vs Volume Trap

The rectangular prism net must show all 6 faces with matching dimensions. The visible-faces trap should clearly show that only 3 faces are visible in a 3-D drawing but 6 faces exist. The open-top box diagram must visibly remove the top face.

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 area measure?

Correct answer: Flat space / area.

Likely wrong answer: Space inside / volume.

Possible misconception: Area and volume are not being separated.

Next move: Cover one face with square units before discussing the whole solid.

2. What unit should area use: cm, cm^2 , or cm^3 ?

Correct answer: cm^2

Likely wrong answer: cm or cm^3

Possible misconception: Dimensional units are not matched to area.

Next move: Connect one face to square units.

3. How many faces does a rectangular prism have?

Correct answer: 6

Likely wrong answer: 3

Possible misconception: Only visible faces are being counted.

Next move: Use a physical box or net to reveal all six faces.

4. What is a net?

Correct answer: A flat pattern that folds to make the solid.

Likely wrong answer: Any group of rectangles.

Possible misconception: The defining purpose of a net is not secure.

Next move: Fold or mentally fold a simple net and check for overlap/gaps.

Ready-to-Learn item 1

Correct answer: Flat space / area.

Likely wrong answer: Space inside / volume.

Misconception: Area and volume are not being separated.

Next move: Cover one face with square units before discussing the whole solid.

Ready-to-Learn item 2

Correct answer: cm^2

Likely wrong answer: cm or cm^3

Misconception: Dimensional units are not matched to area.

Next move: Connect one face to square units.

Ready-to-Learn item 3

Correct answer: 6

Likely wrong answer: 3

Misconception: Only visible faces are being counted.

Next move: Use a physical box or net to reveal all six faces.

Ready-to-Learn item 4

Correct answer: A flat pattern that folds to make the solid.

Likely wrong answer: Any group of rectangles.

Misconception: The defining purpose of a net is not secure.

Next move: Fold or mentally fold a simple net and check for overlap/gaps.

Practice

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

1. cube with side 3 cm

Solution: 1. $SA = 6s^2$ $SA = 6 \times 3^2 = 6 \times 9 = 54$ 54 cm^2

2. cube with side 5 m

Solution: 2. $SA = 6 \times 5^2 = 6 \times 25 = 150$ 150 m^2

3. cube with side 8 cm

Solution: 3. $SA = 6 \times 8^2 = 6 \times 64 = 384$ 384 cm^2

4. cube with side 2.5 m Find the surface area.

Solution: 4. $SA = 6 \times 2.5^2 = 6 \times 6.25 = 37.5$

5. 4 cm by 3 cm by 2 cm

Solution: 5. $SA = 2(4 \times 3) + 2(4 \times 2) + 2(3 \times 2)$ $SA = 24 + 16 + 12 = 52$ 52 cm^2

6. 6 m by 5 m by 4 m

Solution: 6. $SA = 2(6 \times 5) + 2(6 \times 4) + 2(5 \times 4)$ $SA = 60 + 48 + 40 = 148$ 148 m^2

7. 12 cm by 7 cm by 3 cm

Solution: 7. $SA = 2(12 \times 7) + 2(12 \times 3) + 2(7 \times 3)$ $SA = 168 + 72 + 42 = 282$ 282 cm^2

8. 9 m by 4 m by 4 m Find the surface area using the net method.

Solution: 8. $SA = 2(9 \times 4) + 2(9 \times 4) + 2(4 \times 4)$ $SA = 72 + 72 + 32 = 176$ 176 m^2

9. A triangular prism has triangular bases with base 6 cm and perpendicular height 4 cm. The three rectangular faces are 5 cm × 10 cm, 5 cm × 10 cm, and 6 cm × 10 cm.

Solution: 9. Area of one triangular base: $6 \times 4 = 24 \div 2 = 12$ Two triangular bases: $2 \times 12 = 24$
Rectangular faces: $5 \times 10 = 50$ $5 \times 10 = 50$ $6 \times 10 = 60$ Total: $24 + 50 + 50 + 60 = 184$ 184 cm^2

10. A triangular prism has triangular bases with base 8 m and perpendicular height 3 m. The rectangular faces are 5 m × 12 m, 5 m × 12 m, and 8 m × 12 m.

Solution: 10. Area of one triangular base: $8 \times 3 = 24 \div 2 = 12$ Two triangular bases: $2 \times 12 = 24$
Rectangular faces: $5 \times 12 = 60$ $5 \times 12 = 60$ $8 \times 12 = 96$ Total: $24 + 60 + 60 + 96 = 240$ 240 m^2

11. An open-top box is 10 cm long, 6 cm wide, and 4 cm high. Find the outside area.

Solution: 11. Bottom: $10 \times 6 = 60$ Two long sides: $2(10 \times 4) = 80$ Two short sides: $2(6 \times 4) = 48$ Total: $60 + 80 + 48 = 188$ 188 cm^2

12. An open-top box is 8 m long, 5 m wide, and 3 m high. Find the outside area.

Solution: 12. Bottom: $8 \times 5 = 40$ Two long sides: $2(8 \times 3) = 48$ Two short sides: $2(5 \times 3) = 30$ Total: $40 + 48 + 30 = 118$ 118 m^2

13. A student finds $7 \times 4 \times 3$ for the surface area of a rectangular prism. Explain the mistake.

Solution: 13. The student found volume by multiplying length $\times$ width $\times$ height. Surface area means outside covering, so the areas of the faces must be added.

14. A student gives a surface area answer in cm^3 . Explain the unit mistake.

Solution: 14. Surface area uses square units, such as cm^2 . Cubic units are for volume.

15. A student counts only 3 faces from a drawing of a rectangular prism. Explain the mistake.

Solution: 15. A closed rectangular prism has 6 faces. A drawing may only show 3, but the hidden faces still exist and must be counted.

Chapter Answer Key

Tripwire Check

The student is not correct.

$$11 \times 6 \times 5$$

finds volume, not surface area.

Surface area is:

$$SA = 2(11 \times 6) + 2(11 \times 5) + 2(6 \times 5)$$

$$SA = 2(66) + 2(55) + 2(30)$$

$$SA = 132 + 110 + 60$$

$$SA = 302$$

The surface area is:

$$302 \text{ cm}^2$$

Worksheet 1: Guided Practice

1.

a. surface area

b. volume

c. surface area

d. volume

2.

$$4^2 = 16$$

$$SA = 6 \times 16$$

$$SA = 96$$

Surface area:

$$96 \text{ cm}^2$$

3.

Top and bottom:

$$2(5 \times 3) = 30$$

Front and back:

$$2(5 \times 2) = 20$$

Left and right:

$$2(3 \times 2) = 12$$

Total:

$$30 + 20 + 12 = 62$$

Surface area:

$$62 \text{ cm}^2$$

4.

The correct unit is:

$$\text{cm}^2$$

Worksheet 2: Independent Practice

1.

a.

$$6 \times 4^2 = 6 \times 16 = 96$$

$$96 \text{ cm}^2$$

b.

$$6 \times 7^2 = 6 \times 49 = 294$$

$$294 \text{ m}^2$$

c.

$$6 \times 10^2 = 6 \times 100 = 600$$

$$600 \text{ cm}^2$$

d.

$$6 \times 1.5^2 = 6 \times 2.25 = 13.5$$

$$13.5 \text{ m}^2$$

2.

a.

$$SA = 2(5 \times 4) + 2(5 \times 3) + 2(4 \times 3)$$

$$SA = 40 + 30 + 24 = 94$$

$$94 \text{ cm}^2$$

b.

$$SA = 2(8 \times 6) + 2(8 \times 2) + 2(6 \times 2)$$

$$SA = 96 + 32 + 24 = 152$$

$$152 \text{ m}^2$$

c.

$$SA = 2(11 \times 5) + 2(11 \times 4) + 2(5 \times 4)$$

$$SA = 110 + 88 + 40 = 238$$

$$238 \text{ cm}^2$$

d.

$$SA = 2(7 \times 7) + 2(7 \times 3) + 2(7 \times 3)$$

$$SA = 98 + 42 + 42 = 182$$

$$182 \text{ m}^2$$

3.

a. Bottom:

$$6 \times 4 = 24$$

Sides:

$$2(6 \times 3) = 36$$

$$2(4 \times 3) = 24$$

Total:

$$24 + 36 + 24 = 84$$

$$84 \text{ cm}^2$$

b. Bottom:

$$12 \times 5 = 60$$

Sides:

$$2(12 \times 4) = 96$$

$$2(5 \times 4) = 40$$

Total:

$$60 + 96 + 40 = 196$$

$$196 \text{ m}^2$$

4.

a. surface area

b. volume

c. surface area

d. volume or capacity

Worksheet 3: Mixed Practice & Application

1.

a. Surface area, because wrapping paper covers the outside.

b.

$$SA = 2(12 \times 8) + 2(12 \times 5) + 2(8 \times 5)$$

$$SA = 192 + 120 + 80$$

$$SA = 392$$

$$392 \text{ cm}^2$$

2.

a. The top should not be counted because the bin has no top.

b. Bottom:

$$15 \times 10 = 150$$

Long sides:

$$2(15 \times 6) = 180$$

Short sides:

$$2(10 \times 6) = 120$$

Total:

$$150 + 180 + 120 = 450$$

$$450 \text{ cm}^2$$

3.

One triangular end:

$$4 \times 3 = 12 \div 2 = 6$$

Two triangular ends:

$$2 \times 6 = 12$$

Rectangular faces:

$$5 \times 10 = 50$$

$$5 \times 10 = 50$$

$$4 \times 10 = 40$$

Total:

$$12 + 50 + 50 + 40 = 152$$

The surface area is:

$$152 \text{ m}^2$$

4.

The student found volume, not surface area.

Correct surface area:

$$SA = 2(9 \times 5) + 2(9 \times 4) + 2(5 \times 4)$$

$$SA = 90 + 72 + 40$$

$$SA = 202$$

$$202 \text{ cm}^2$$

5.

Surface area uses square units, not cubic units.

Correct unit:

cm^2

not:

cm^3

6.

A drawing may show only 3 faces, but a closed rectangular prism has 6 faces. The hidden faces still exist and must be counted for total surface area.

Diagnostic Key — High-Leverage Items

Tripwire Check

Correct answer: No. $8 \times 5 \times 3$ finds volume. Surface area is $2(8 \times 5) + 2(8 \times 3) + 2(5 \times 3) = 158 \text{ cm}^2$.

Likely wrong answer: 120 cm^2 .

Misconception: A volume procedure is being used for an outside-covering question.

Next move: Unfold/picture the six faces and add their areas; ask “wrap or fill?” before selecting a method.

Tripwire Diagnostic

Correct answer: No. $11 \times 6 \times 5$ finds volume. Surface area is $2(11 \times 6) + 2(11 \times 5) + 2(6 \times 5) = 302 \text{ cm}^2$.

Likely wrong answer: 330 cm^2 .

Misconception: A volume procedure is being used for an outside-covering question.

Next move: Unfold/picture the six faces and add their areas; ask “wrap or fill?” before selecting a method.

Exit Ticket Diagnostic — High-Leverage Item

Correct answer: 62 cm^2 .

Likely wrong answer: 30 cm^3 or 30 cm^2

Misconception: Volume multiplication $l \times w \times h$ is being used for an outside-covering question.

Next move: List the six face areas or three face pairs, then add them; keep square units.

Variation Lab — Expected Ideas

1. Same prism: wrapping/painting asks for surface area; filling asks for volume.
2. Open top means omit that face; a closed prism includes all six faces.
3. Net/face-pair reasoning should count every exposed face exactly once.

Transfer Check — Suggested Responses

Familiar: 150 cm^2 . **Altered:** $2(24 + 18 + 12) = 108 \text{ cm}^2$. **Non-routine:** bottom $60 +$ two $40 +$ two $24 = 188 \text{ cm}^2$.

Repair: $2(40 + 24 + 15) = 158 \text{ cm}^2$.

Exit Ticket — Answers

1. 96 cm^2
2. 62 cm^2
3. Surface area is made of 2-D face areas, so square units are required.