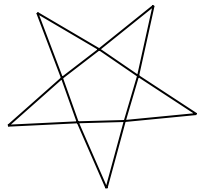
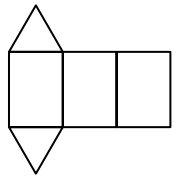
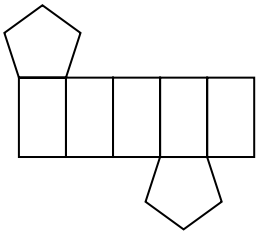
CHAPTER 11

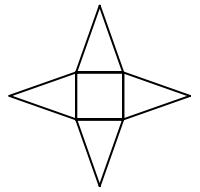
# 1 Visualizing and Constructing Polyhedrons

**Goal** **Visualize and build polyhedrons from 2-D nets.**

A. 

B. 

C. 

D. 

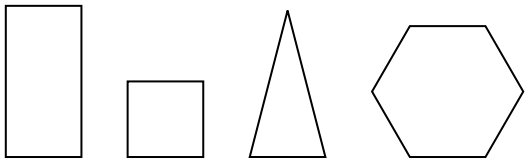
**1.** Which are nets of pyramids? How can you tell?

nets A and D
Suggested answer: Pyramids have triangular faces, except for the base. Both these nets have triangles.

**2.** Which are nets of prisms? How can you tell?

nets B and C
Suggested answer: Prisms have rectangular faces, except for the top and base. Both these nets have rectangles.

**3.** What nets can you make from these shapes? Sketch each net and name the polyhedron it would make.

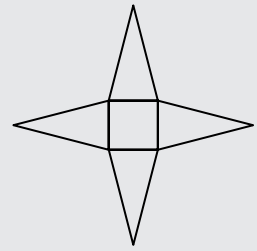


## At-Home Help

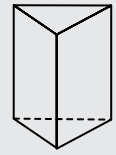
A **polyhedron** is a closed three-dimensional shape with polygons as faces. Pyramids and prisms are two kinds of polyhedrons.

For example:

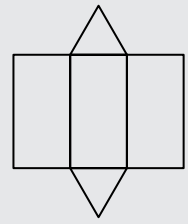
pyramid



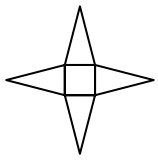
net of pyramid



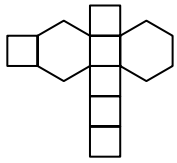
prism



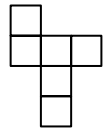
net of prism



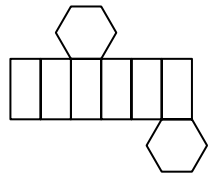
square-based pyramid



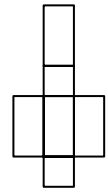
hexagonal prism



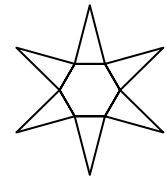
cube



hexagonal prism



rectangular prism

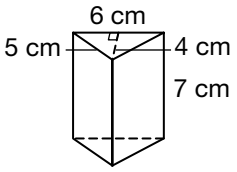


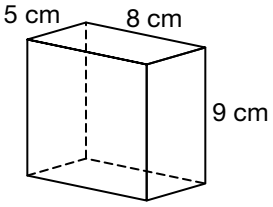
hexagonal pyramid

CHAPTER 11

# 2 Surface Area of Polyhedrons

**Goal** **Determine the surface area of triangular and rectangular prisms.**

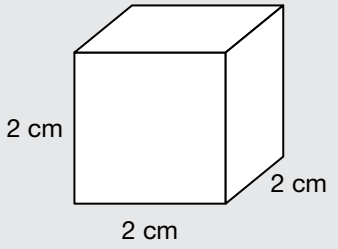



## At-Home Help

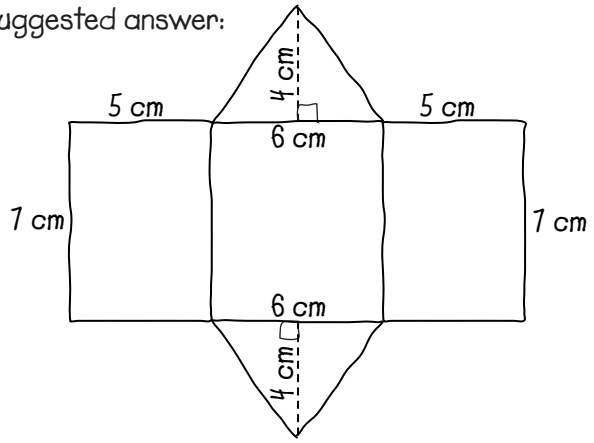
The **surface area** of a polyhedron is the total area of all of the faces, or surfaces, of that polyhedron.

For example, the surface area of this cube is 24 $cm^2$ because each face has an area of 4 $cm^2$.




**1. a)** Sketch a net for the triangular prism. Label the dimensions.

Suggested answer:




**b)** Determine the surface area of the triangular prism.

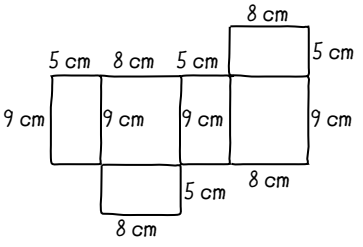
area of prism = area of 2 triangles + area of one 7 cm by 6 cm rectangle + area of two 7 cm by 5 cm rectangles

$= 2 \times (6\text{ cm} \times 4\text{ cm} \div 2) + (7\text{cm} \times 6\text{ cm}) + 2 \times (7\text{ cm} \times 5\text{ cm})$

$= 24\text{ cm}^2 + 42\text{ cm}^2 + 70\text{ cm}^2$

$= 136\text{ cm}^2$

**2. a)** Sketch a net for the rectangular prism. Label the dimensions.




**b)** Determine the surface area of the rectangular prism.

area of prism = area of two 5 cm by 9 cm rectangles + area of two 8 cm by 9 cm rectangles + area of two 5 cm by 8 cm rectangles

$= 2 \times (9\text{ cm} \times 5\text{ cm}) + 2 \times (9\text{ cm} \times 8\text{ cm}) + 2 \times (8\text{ cm} \times 5\text{ cm})$

$= 2 \times 45\text{ cm}^2 + 2 \times 72\text{ cm}^2 + 2 \times 40\text{ cm}^2$

$= 90\text{ cm}^2 + 144\text{ cm}^2 + 80\text{ cm}^2$

$= 314\text{ cm}^2$

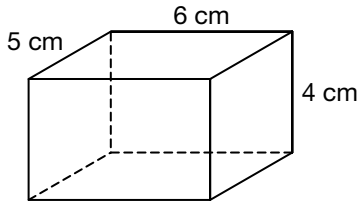
CHAPTER 11

# 3 Volume of Rectangular and Triangular Prisms

**Goal** **Calculate the volume of rectangular and triangular prisms.**

**1.** Determine the volume of each rectangular prism.

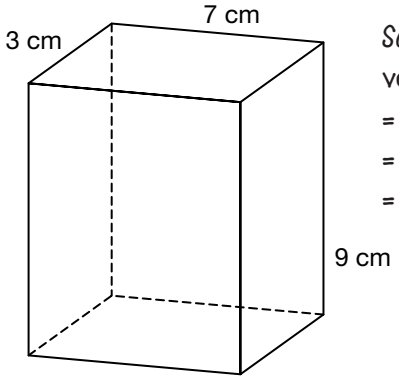
**a)**




Suggested answer:
area of base
= length x width
= 5 cm x 6 cm
= 30 $cm^2$

volume of prism
= area of base x height
= 30 $cm^2$ x 4 cm
= 120 $cm^3$

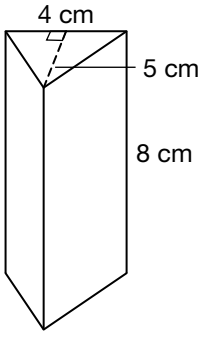
**b)**




Suggested answer:
volume of prism
= length x width x height
= 7 cm x 3 cm x 9 cm
= 189 $cm^3$

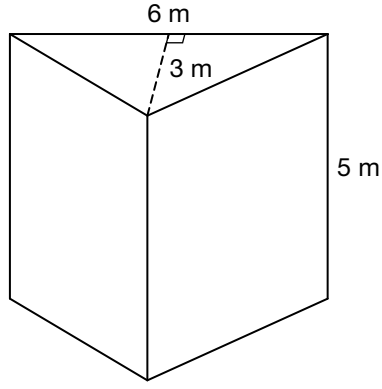
**2.** Determine the volume of each triangular prism.

**a)**




Suggested answer:
volume of prism = area of base x height
= (4 cm x 5 cm ÷ 2) x 8 cm
= 10 $cm^2$ x 8 cm
= 80 $cm^3$

**b)**

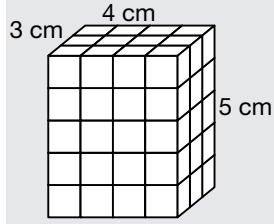


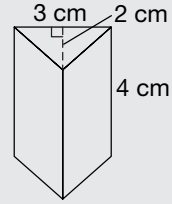

Suggested answer:
volume of prism = area of base x height
= (6 m x 3 m ÷ 2) x 5 m
= 9 $m^2$ x 5 m
= 45 $m^3$

## At-Home Help

**Volume** is the amount of space an object takes up.

You can calculate the volume of a prism using the rule
Volume = area of base × height.




Volume of rectangular prism
= area of base × height
= (length × width) × height
= (4 cm × 3 cm) × 5 cm
= 12 $cm^2$ × 5 cm
= 60 $cm^3$

Volume of triangular prism
= area of base × height
= (3 cm × 2 cm ÷ 2) × 4 cm
= 3 $cm^2$ × 4 cm
= 12 $cm^3$

CHAPTER 11

4

# Solve Problems by Making a Model

**Goal** **Make models to solve problems.**

**You will need centimetre cubes.**

**1.** Jared is building rectangular prisms with 12 centimetre cubes.

**a)** Which prism has the least surface area?

Suggested answer:

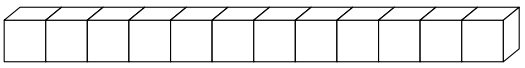
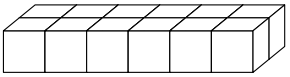
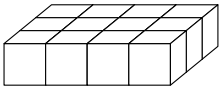
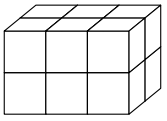
Understand the Problem

I need to determine the dimensions of the rectangular prism with the least surface area.

Make a Plan

I'll model the prism using 12 centimetre cubes.
I'll make rectangular prisms with the cubes and calculate the surface area of each one.
I'll record my results in a chart.

Carry Out the Plan

| Prism | Surface area |
|---|---|
|  | surface area = 50 $cm^2$ |
|  | surface area = 40 $cm^2$ |
|  | surface area = 38 $cm^2$ |
|  | surface area = 32 $cm^2$ |

The prism that is 3 cm long, 2 cm wide, and 2 cm high has the least surface area.
The surface area of this prism is 32 $cm^2$.

**b)** What is the volume of the prism in part **a)**?

Suggested answer: volume of prism = length x width x height
= 3 cm x 2 cm x 2 cm
= 12 $cm^3$

## At-Home Help

Sometimes making a model is a good way to solve a problem.

For example: A rectangular prism has a volume of 24 $cm^3$ and a surface area of 56 $cm^2$. What are the dimensions of the prism?

You can use centimetre cubes to make a model. Experiment with different prisms to find the one that has a surface area of 56 $cm^2$.

The prism that is 6 cm long, 2 cm wide, and 2 cm high has a volume of 24 $cm^3$ and a surface area of 56 $cm^2$.

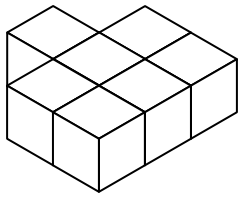
CHAPTER 11

# 5 Creating Isometric Sketches

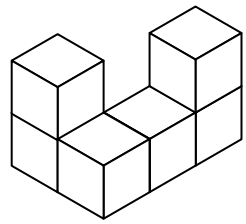
**Goal** **Sketch a polyhedron built from cubes.**

**You will need linking cubes.**

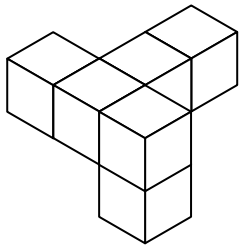
**a)**



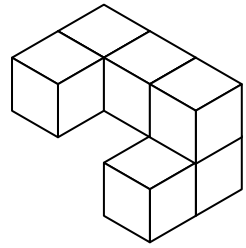
**c)**



**b)**



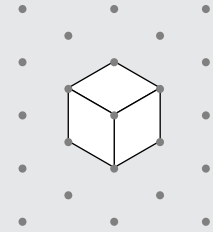
**d)**



## At-Home Help

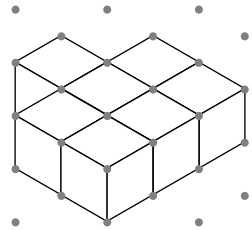
An **isometric drawing** is a three-dimensional view of an object that can be drawn on isometric dot paper. All equal lengths on the cubes are equal on the grid.

For example, the vertices of this cube are placed on the dots.

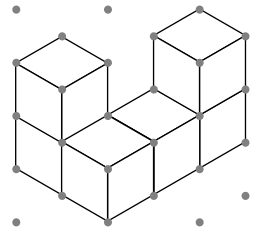


**1.** Build the cube structures shown. Sketch each structure on isometric dot paper.

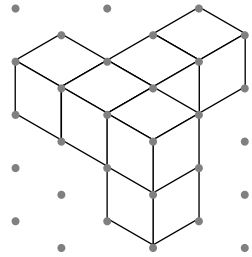
**a)**



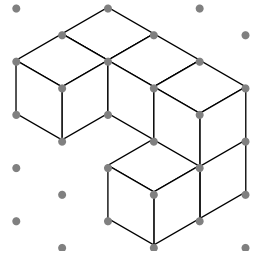
**c)**



**b)**



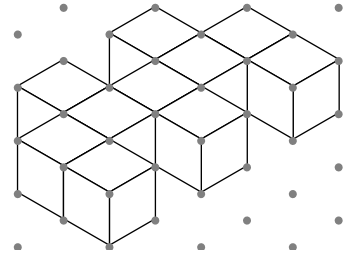
**d)**



**2.** **a)** Build a structure using up to 10 linking cubes.

**b)** Sketch your structure on isometric dot paper.

*Suggested answer:*



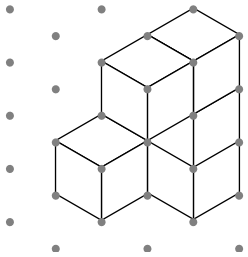
CHAPTER 11

6

# Creating Cube Structures from Sketches

**Goal** **Create cube structures based on an isometric sketch.**

**You will need linking cubes.**

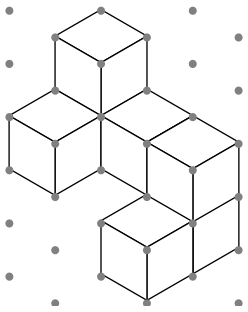


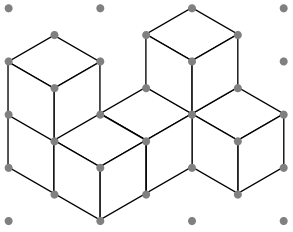
**1. a)** Build a cube structure based on the isometric drawing. How many cubes did you use?

__7__ cubes

**b)** Sketch at least two views of your cube structure so someone else could build it exactly as you did.

*Suggested answer:*



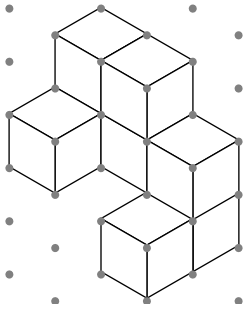


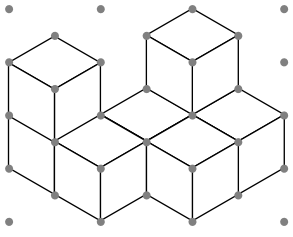
**2. a)** Build another cube structure using more cubes than you used in Question 1.

How many cubes did you use? __8__ cubes

**b)** Sketch at least two views of your cube structure so someone else could build it exactly as you did.

*Suggested answer:*

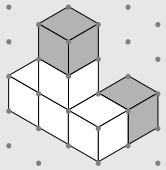


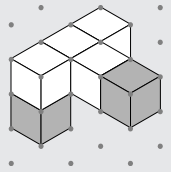


## At-Home Help

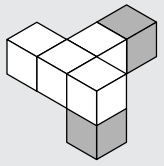
It is possible to build cube structures based on isometric drawings.

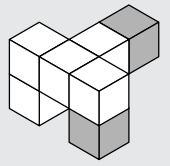
For example, the isometric drawings below represent a cube structure.





Two cube structures that match the drawing would be





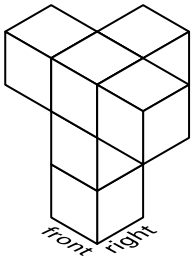
In order to know exactly how many cubes to use, you need more than one drawing to show what the cube structure looks like.

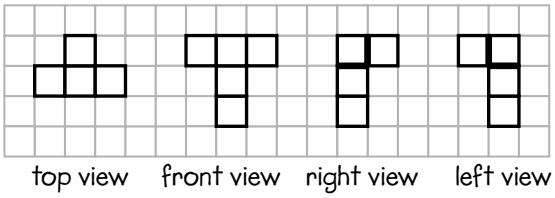
CHAPTER 11

# 7 Different Views of a Cube Structure

**Goal** **Draw top, front, and side views of a cube structure.**

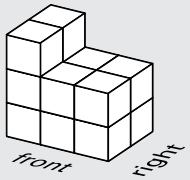
**1.** Sketch the top, front, right, and left views of this cube structure.



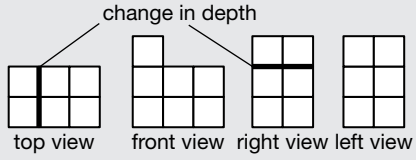




## At-Home Help

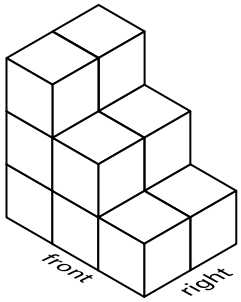
Cube structures can be represented accurately if their top, front, and side views are shown.

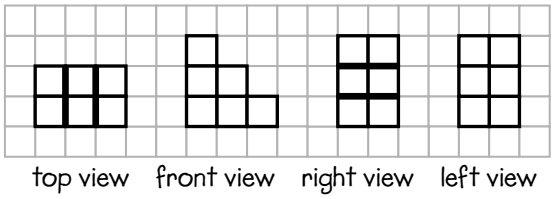



For example, the cube structure above can be represented by top, front, and side views.




**2.** **a)** Sketch the top, front, right, and left views of this cube structure.




**b)** Why is it important to include both side views?

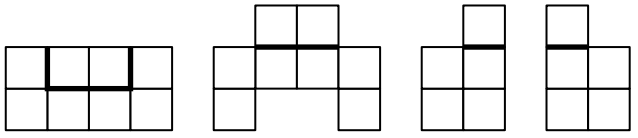
*Suggested answer:* The right view shows changes in depth, which means there are steps. If you don't draw the left view, you might think that there are steps on that side too. The structure does not have any changes in depth on the left view. So the left view looks different from the right view.

CHAPTER 11

# 8 Creating Cube Structures from Different Views

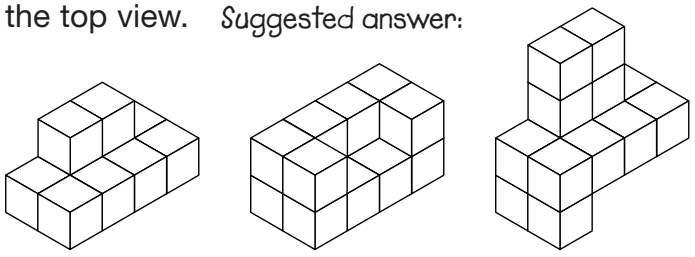
**Goal** **Make cube structures when given their top, front, and side views.**

**You will need linking cubes.**



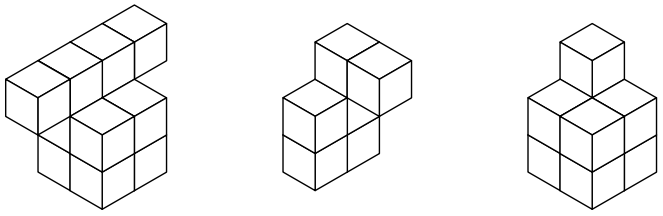

**1. a)** Make three different cube structures that match the top view.

Suggested answer:



**b)** Make three different cube structures that match the right view. Do any of your cube structures match both the top and right views?

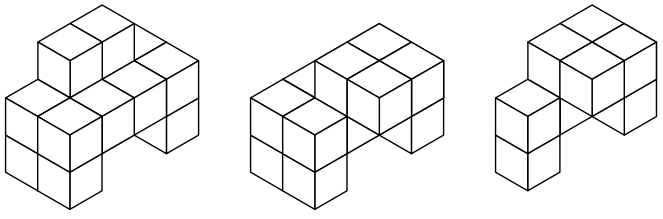
Suggested answer:



None of my cube structures for part b) has a top view that matches.

**c)** Make several different cube structures that match the front view. Do any of your cube structures match all four views?

Suggested answer:

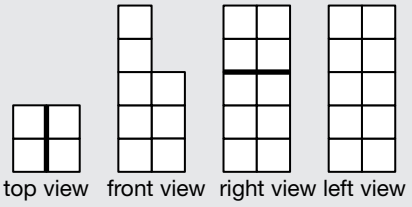


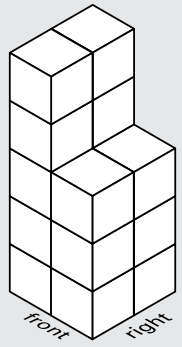
Yes, my first structure in part c) matches all four views.

## At-Home Help

A cube structure can be constructed when its top, front, and side views are given.

For example, if you are given these views, you can build the appropriate cube structure.

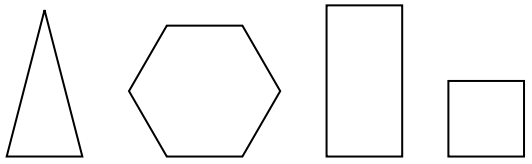


# Test Yourself Page 1

**Circle the correct answer.**

Use the polygons below to answer Questions 1 and 2.



**1.** Which combination of shapes would make a pyramid?

**A.** 3 triangles, 1 square

**B.** 4 triangles, 1 rectangle

**C.** 5 triangles, 1 hexagon

**D.** 6 triangles, 1 hexagon

**2.** Which combination of shapes would *not* make a prism?

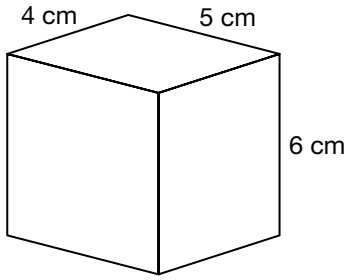
**A.** 2 hexagons, 3 rectangles, 3 squares

**B.** 2 hexagons, 6 rectangles

**C.** 2 triangles, 3 rectangles

**D.** 2 triangles, 3 squares

Use the prism below to answer Questions 3 and 4.




**3.** What is the surface area of the rectangular prism?

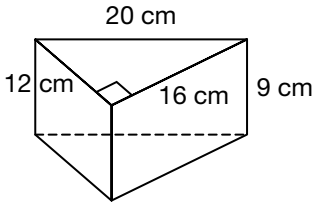
**A.** 74 $cm^2$ **B.** 120 $cm^2$ **C.** 148 $cm^2$ **D.** 240 $cm^2$

**4.** What is the volume of the rectangular prism?

**A.** 74 $cm^3$ **B.** 120 $cm^3$ **C.** 148 $cm^3$ **D.** 240 $cm^3$

# Test Yourself Page 2

Use the prism below to answer Questions 5 and 6.



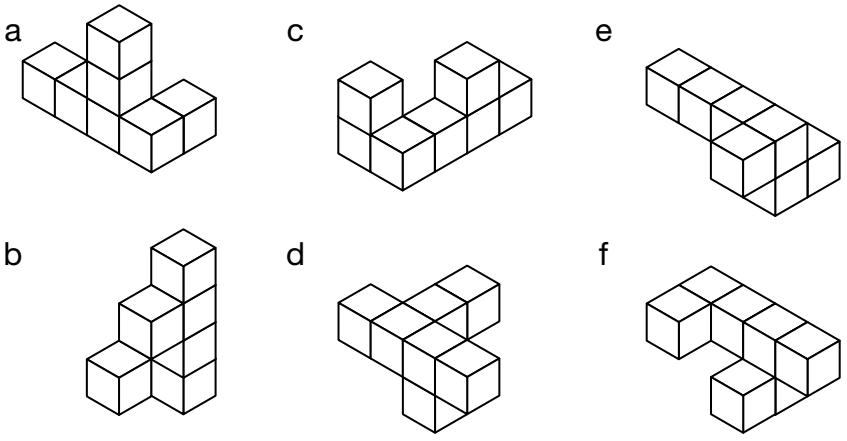

**5.** What is the surface area of the triangular prism?

**A.** 624 $cm^2$ **B.** 424 $cm^2$ **C.** 570 $cm^2$ **D.** 1040 $cm^2$

**6.** What is the volume of the triangular prism?

**A.** 960 $cm^3$ **B.** 2800 $cm^3$ **C.** 864 $cm^3$ **D.** 2240 $cm^3$

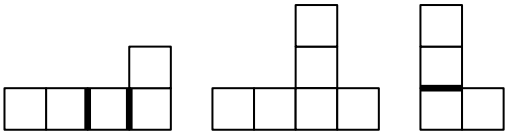
**7.** All of the cube structures below are made with seven cubes. Which ones are the same?



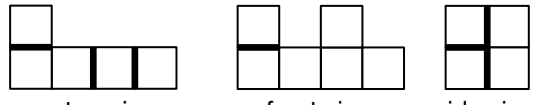

**A.** a, d **B.** b, c **C.** b, e **D.** a, f

**8.** Which top, front, and side views match cube structure c in Question 7?

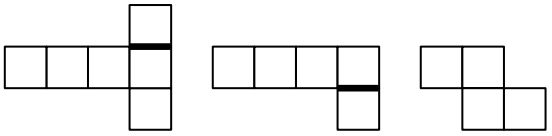
**A.**




**C.**




**B.**




**D.**