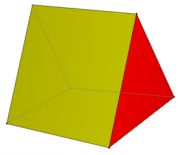
Section 1.4: Surface Areas of Other Composite Objects

Surface Area of Triangular Prisms

Recall: In a triangular prism, there are:

1. 2 congruent triangles
2. 3 rectangles



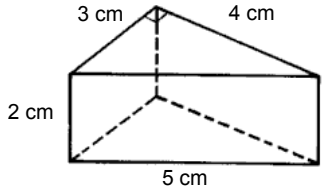
$$Area_{Triangle} = \frac{b \times h}{2}$$

$$Area_{Rectangle} = L \times W$$

Determine the surface area of each triangular prism:

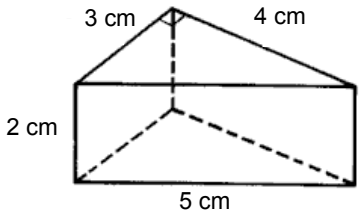
A. Triangular Faces:

A = (base x height) ÷ 2
= (3 cm x 4 cm) ÷ 2
= 12 cm^2 ÷ 2
= 6 cm^2 each



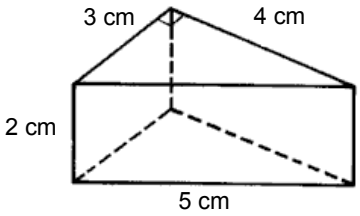
Rectangular Faces:

1st Rectangle = L x W
= 3 cm x 2 cm
= 6 cm^2



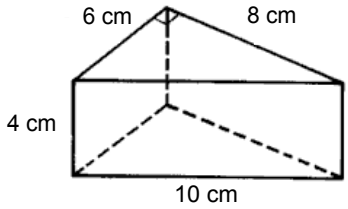
2nd Rectangle = L x W
= 4 cm x 2 cm
= 8 cm^2

3rd Rectangle = L x W
= 5 cm x 2 cm
= 10 cm^2



Total Surface Area = 2(Triangles) + Area of 3 Rectangles
= 2(6 cm^2) + 6 cm^2 + 8 cm^2 +10 cm^2
= 12 cm^2 + 6 cm^2 + 8 cm^2 + 10 cm^2
= 36 cm^2

B. Triangular Faces:



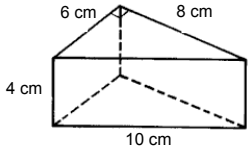
A = (base x height) ÷ 2
= (6 cm x 8 cm) ÷ 2
= 48 cm^2 ÷ 2
= 24 cm^2 each

Rectangular Faces:

1st Rectangle = L x W
= 10 cm x 4 cm
= 40 cm^2

2nd Rectangle = L x W
= 8 cm x 4 cm
= 32 cm^2

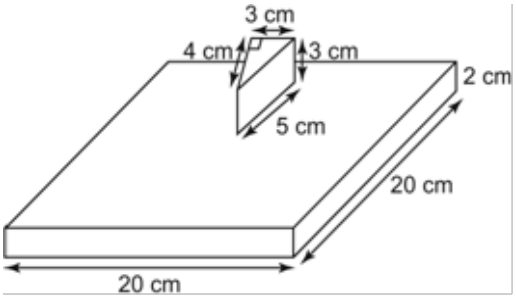
3rd Rectangle = L x W
= 6 cm x 4 cm
= 24 cm^2



Total Surface Area = 2(Triangles) + Area of 3 Rectangles
= 2(24 cm^2) + 40 cm^2 + 32 cm^2 +24 cm^2
= 48 cm^2 + 40 cm^2 + 32 cm^2 + 24 cm^2
= 144 cm^2

Finding the Surface Area of a Composite Object Using Triangular Prisms

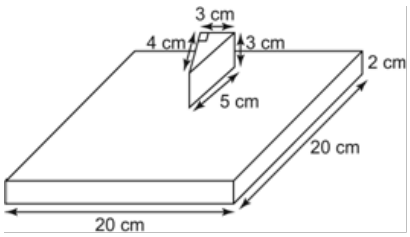
A. Step 1. Calculate the surface area of the larger prism.



SA $= 2lw + 2lh + 2wh$
$= 2(20)(20) + 2(20)(2) + 2(20)(2)$
$= 800 + 80 + 80$
$= 960\ cm^2$

Step 2. Calculate the surface area of the smaller prism.

Triangle = (base x height) ÷ 2
= (3 cm x 4 cm) ÷ 2
= 12 cm^2 ÷ 2
= 6 cm^2 each



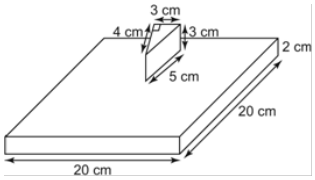
Rectangle 1 = L x W
= 3 cm x 3 cm
= 9 cm^2

Rectangle 2 = L x W
= 4 cm x 3 cm
= 12 cm^2

Rectangle 3 = L x W
= 5 cm x 3 cm
= 15 cm^2

Total Surface Area = 2(Triangles) + Area of 3 Rectangles
= 2(6 cm^2) + 9 cm^2 + 12 cm^2 +15 cm^2
= 12 cm^2 + 9 cm^2 + 12 cm^2 + 15 cm^2
= 48 cm^2

Step 3. Calculate the overlap.



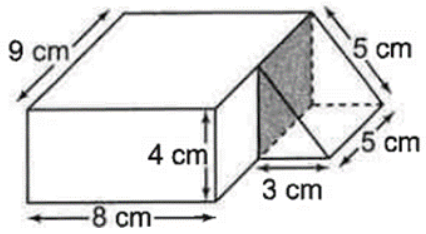
Overlap = (base x height) ÷ 2
= (3cm x 4cm) ÷ 2
= (12cm^2) ÷ 2
= 6cm^2

Step 4. Calculate the surface area of the composite object.

Surface Area of Composite Object

= SA large prism + SA small prism - 2(overlap)
= 960 cm^2 + 48 cm^2 - 2(6 cm^2)
= 960 cm^2 + 48 cm^2 - 12 cm^2
= 996 cm^2

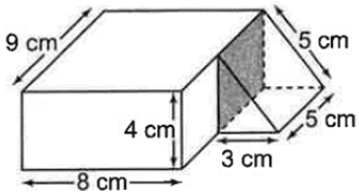
Practice: Calculate the surface area of the following object



Step 1:
Rectangular Prism = 2lw + 2lh + 2wh
= 2(8)(9) + 2(8)(4) + 2(9)(4)
= 144 + 64 + 72
= 280 cm^2

Step 2. Calculate the surface area of the smaller prism.

Triangle = (base x height) ÷ 2
= (3 cm x 4 cm) ÷ 2
= 12 cm² ÷ 2
= 6 cm² each



Rectangle 1 = L x W
= 3 cm x 5 cm
= 15 cm²

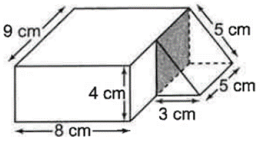
Rectangle 2 = L x W
= 5 cm x 4 cm
= 20 cm²

Rectangle 3 = L x W
= 5 cm x 5 cm
= 25 cm²

Total Surface Area = 2(Triangles) + Area of 3 Rectangles
= 2(6 cm²) + 15 cm² + 20 cm² + 25 cm²
= 12 cm² + 15 cm² + 20 cm² + 25 cm²
= 72 cm²

Step 3. Calculate the overlap.

Overlap = L x W
= 5 cm x 4 cm
= 20 cm²



Step 4. Calculate the surface area of the composite object.

Surface Area of Composite Object

= SA large prism + SA small prism - 2(overlap)
= 280 cm² + 72 cm² - 2(20 cm²)
= 280 cm² + 72 cm² - 40 cm²
= 312 cm²

Surface Area of a Cylinder

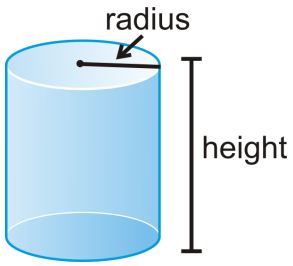
Recall: To find the surface area of a cylinder, we will need the following areas:

1. 2 circular faces (top/bottom)

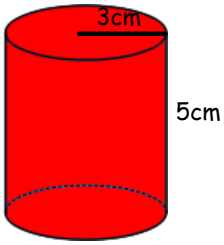
$$\text{Area}_{\text{Circle}} = \pi r^2$$

2. the curved surface (the rectangle whose length is the circumference of the circle)

$$\text{Area} = 2\pi rh$$



Determine the surface area of the following cylinder:



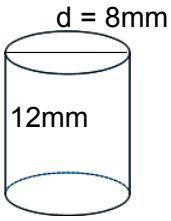
$A_{\text{Circles}} = 2\pi r^2$
$= 2(3.14)(3\text{ cm})^2$
$= 2(3.14)(9\text{ cm}^2)$
$= 56.52\text{ cm}^2$

$A_{\text{Curved Surface}} = 2\pi rh$
$= (2)(3.14)(3\text{cm})(5\text{ cm})$
$= 94.2\text{ cm}^2$

$SA_{\text{Cylinder}} = 2\pi r^2 + 2\pi rh$
$= 56.52\text{ cm}^2 + 94.2\text{ cm}^2$
$= 150.72\text{ cm}^2$

Practice: Determine the surface area:

Recall: $r = d \div 2$
$= 8 \text{ mm} \div 2$
$= 4 \text{ mm}$



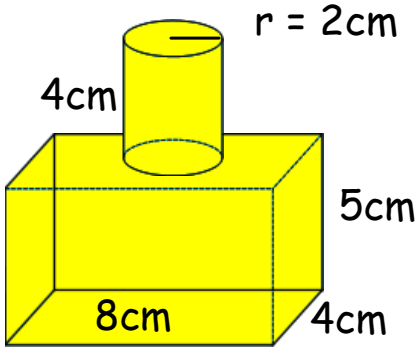
$A_{\text{Circles}} = 2\pi r^2$
$= 2(3.14)(4 \text{ mm})^2$
$= 2(3.14)(16 \text{ mm}^2)$
$= 100.48 \text{ mm}^2$

$A_{\text{Curved Surface}} = 2\pi rh$
$= (2)(3.14)(4 \text{ mm})(12 \text{ mm})$
$= 301.44 \text{ mm}^2$

$SA_{\text{Cylinder}} = 2\pi r^2 + 2\pi rh$
$= 100.48 \text{ mm}^2 + 301.44 \text{ mm}^2$
$= 401.92 \text{ mm}^2$

Finding the Surface Area of a Composite Object Using Cylinders

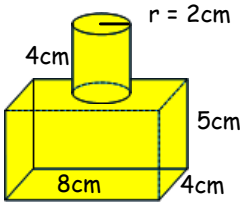
A. Step 1. Calculate the surface area of the larger prism.



Rectangular Prism $= 2lw + 2lh + 2wh$
$= 2(8)(4) + 2(8)(5) + 2(4)(5)$
$= 64 + 80 + 40$
$= 184\ cm^2$

Step 2. Calculate the surface area of the smaller prism.

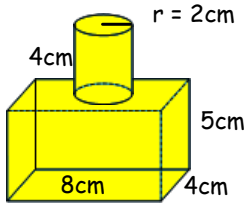
$A_{Circles} = 2\pi r^2$
$= 2(3.14)(2\ cm)^2$
$= 2(3.14)(4\ cm^2)$
$= 25.12\ cm^2$



$A_{Curved\ Surface} = 2\pi rh$
$= 2(3.14)(2\ cm)(4\ cm)$
$= 50.24\ cm^2$

$SA_{Cylinder} = 2\pi r^2 + 2\pi rh$
$= 25.12\ cm^2 + 50.24\ cm^2$
$= 75.36\ cm^2$

Step 3. Calculate the overlap.



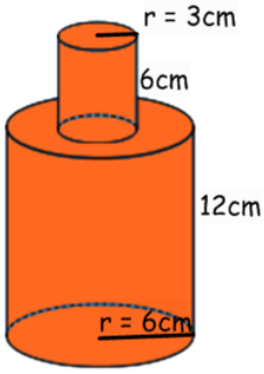
Overlap $= \pi r^2$
$= (3.14)(2\text{ cm})^2$
$= (3.14)(4\text{ cm}^2)$
$= 12.56\text{ cm}^2$

Step 4. Calculate the surface area of the composite object.

Surface Area of Composite Object

= SA large prism + SA small prism - 2(overlap)
$= 184\text{ cm}^2 + 75.36\text{ cm}^2 - 2(12.56\text{ cm}^2)$
$= 184\text{ cm}^2 + 75.36\text{ cm}^2 - 25.12\text{ cm}^2$
$= 234.24\text{ cm}^2$

Practice: Find the SA of the following composite object:



$A_{\text{Circles}} = 2\pi r^2$
$= 2(3.14)(6\text{ cm})^2$
$= 2(3.14)(36\text{ cm}^2)$
$= 226.08\text{ cm}^2$

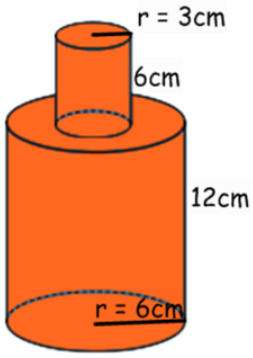
$A_{\text{Curved Surface}} = 2\pi rh$
$= 2(3.14)(6\text{ cm})(12\text{ cm})$
$= 452.16\text{ cm}^2$

$SA_{\text{Cylinder}} = 2\pi r^2 + 2\pi rh$
$= 226.08\text{ cm}^2 + 452.16\text{ cm}^2$
$= 678.24\text{ cm}^2$

Step 2. Calculate the surface area of the smaller prism.

$A_{Circles} = 2\pi r^2$
$= 2(3.14)(3\ cm)^2$
$= 2(3.14)(9\ cm^2)$ $= 56.52$ cm

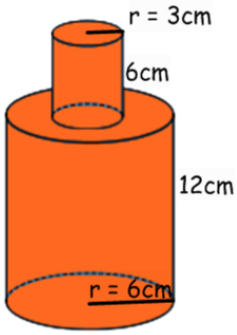
$A_{Curved\ Surface}$ $= 2\pi rh$ $= 2(3.14)($
cm) $= 113.04\ cm^2$



$SA_{Cylinder} = 2\pi r^2 + 2\pi rh$
$= 56.52\ cm^2 + 113.04\ cm^2$
$= 169.56\ cm^2$

Step 3. Calculate the overlap.

Overlap $= \pi r^2$
$= (3.14)(3\ cm)^2$
$= (3.14)(9\ cm^2)$
$= 28.26\ cm^2$



Step 4. Calculate the surface area of the composite object.

Surface Area of Composite Object

= SA large prism + SA small prism - 2(overlap)
$= 678.24\ cm^2 + 169.56\ cm^2 - 2(28.26\ cm^2)$
$= 678.24\ cm^2 + 169.56\ cm^2 - 56.52\ cm^2$
$= 791.28\ cm^2$

Practice Exercises: p. 40 #3d, e.

Practice Exercises: p. 40 #3a, 4a, 5a.