Surface Area of Composite 3D Objects

Three-dimensional (3D) composite objects are made of two or more objects put together. To calculate the surface area of a 3D composite object, find the outside surface area of each object and then add the surface areas together.
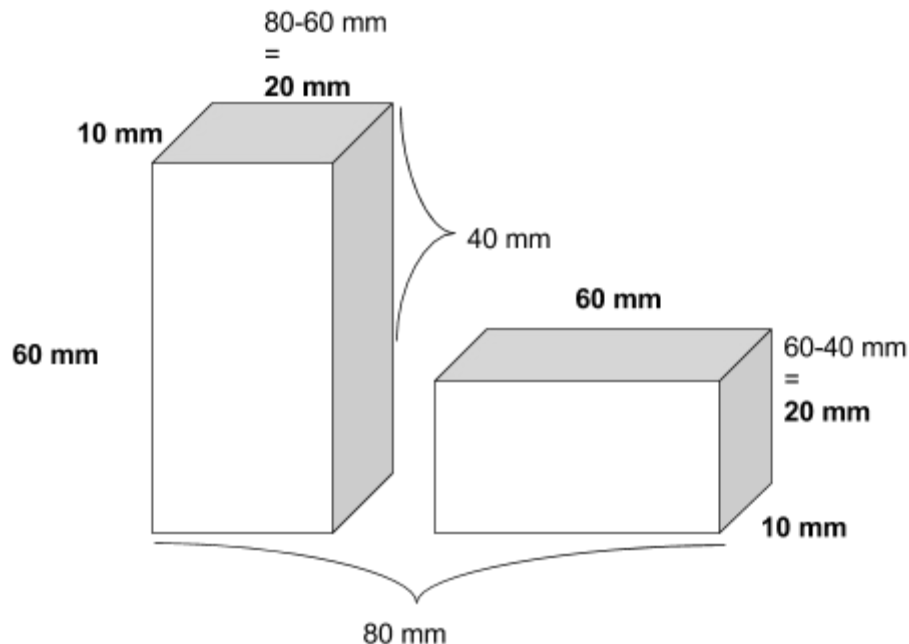
Example 1
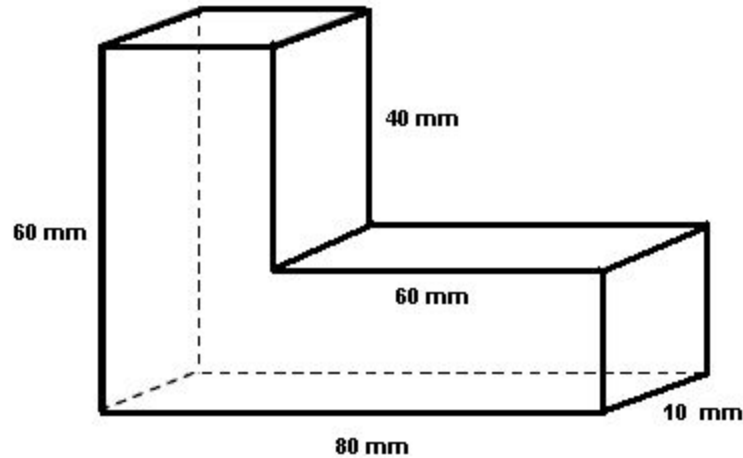
Find the surface area of the given composite object. _____mm²

Solution

Step 1
Break the object into two rectangular prisms:
one on the left and one on the right

It could also be broken into one on top and one on the bottom.

Step 2

Determine the surface area of the outside faces of the right prism.
There are five faces - front and back, top and bottom, and right side. There is no left side because it is attached to the other prism.

$A_{\text{front and back}}$ $= 2(lh)$
$= 2(20 \times 60)$
$= 2400 \text{ mm}^2$

$A_{\text{top and bottom}}$ $= 2(lw)$
$= 2(60 \times 10)$
$= 1200 \text{ mm}^2$

$A_{\text{right side}}$ $= wh$
$= 20 \times 10$
$= 200 \text{ mm}^2$

$SA_{\text{right rectangular prism}}$ $= A_{\text{front and back}} + A_{\text{top and bottom}} + A_{\text{right side}}$
$= 2400 + 1200 + 200$
$= 3800 \text{ mm}^2$

The surface area of the outside faces of the right rectangular prism is 3800 mm².

Step 3

Determine the surface are of the outside faces of the left prism.
There are six faces - front and back, top and bottom, left, and a partial right side

$A_{\text{front and back}}$ $= 2(lh)$
$= 2(20 \times 60)$
$= 2400 \text{ mm}^2$

$A_{\text{top and bottom}}$ $= 2(lw)$
$= 2(20 \times 10)$
$= 400 \text{ mm}^2$

$A_{\text{left side}}$ $= wh$
$= 60 \times 10$
$= 600 \text{ mm}^2$

$A_{\text{right side}}$ $= wh - A_{\text{left side of right prism}}$
$= 60 \times 10 - 200$
$= 400 \text{ mm}^2$

$SA_{\text{left rectangular prism}}$ $= A_{\text{front and back}} + A_{\text{top and bottom}} + A_{\text{left side}} + A_{\text{right side}}$
$= 2400 + 400 + 600 + 400$
$= 3800 \text{ mm}^2$

The surface area of the outside faces of the left rectangular prism is 3800 mm².

Step 4

Find the surface area of all the outside faces of the composite object.

$SA_{composite\ figure}$ = $SA_{right\ rectangular\ prism}$ + $SA_{left\ rectangular\ prism}$
= 3800 + 3800
= 7600 mm^2

The total surface area of the composite object is 7600 mm^2.

Special attention must be given to the area common to the different objects. Make sure it is not included in the surface area of each object and that it is subtracted from the surface area of each object.

Composite objects are often made up of different types of objects including a combination of rectangular prisms, triangular prisms, or cylinders.

Example 2

A composite object is illustrated in the given diagram.
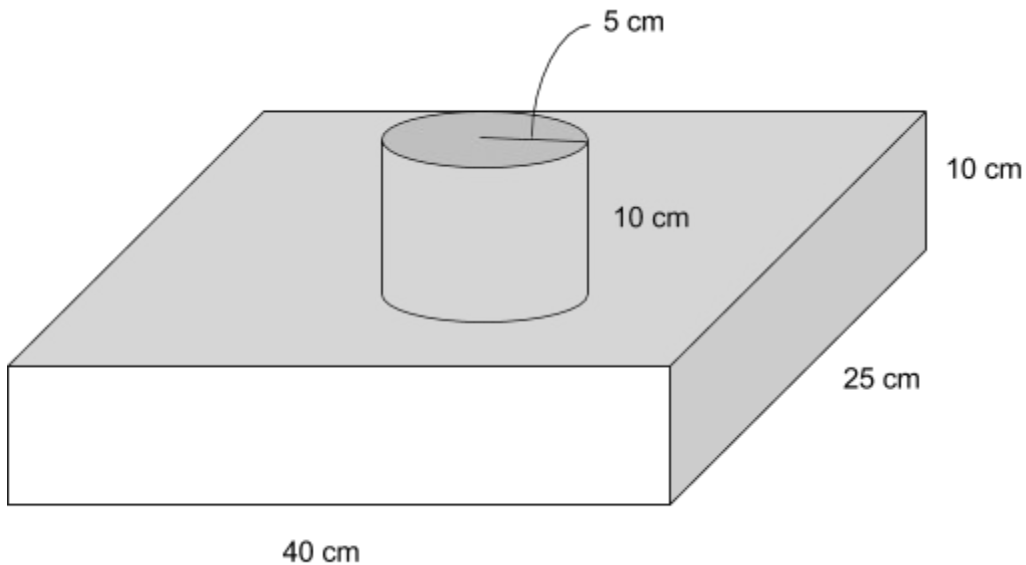
The surface area of the composite object, to the nearest whole number, is _____ cm^2.

Solution

Step 1
Calculate the surface area of the rectangular prism.

Front and Back (2 Equal Rectangles)

$A_{front\ and\ back}$ = 2(*l* x *w*)
= 2(40 x 10)
= 2(400)
= 800 cm^2

Sides (2 equal rectangles)

A_{sides} = 2(l x w)
     = 2(25 x 10)
     = 2(250)
     = 500 cm^2

Bottom and Top

A_{bottom} = l x w
     = 40 x 25
     = 1000 cm^2

Before we calculate the area of the top let us take a bird's eye view of it.

5 cm

25 cm

40 cm
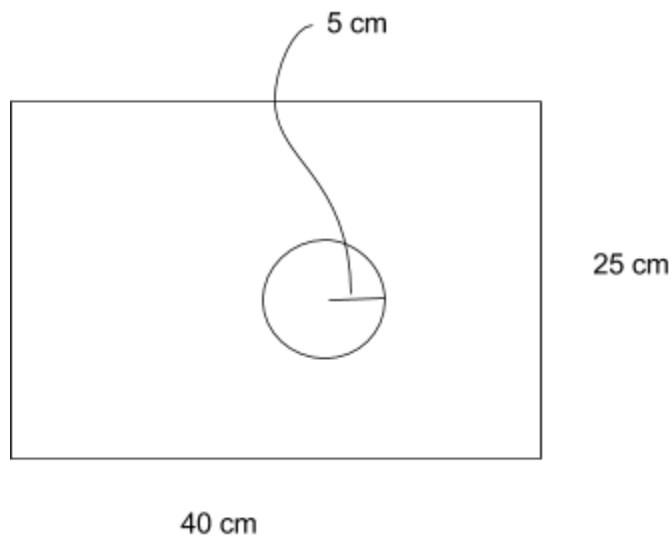
Now we could look at this shape as 2 different pieces and calculate the area of the rectangle then subtract the area of the circle… then later calculate the area of the circle and add it to the total surface area… we could use the fact that when we calculate the Total surface area of the rectangle the circle will be included and not even calculate it. EUREKA! Save use some work!

(*Go back and look at the original* **Example 1**… *Could we have used this same idea there as well?*)

5 cm

25 cm

40 cm
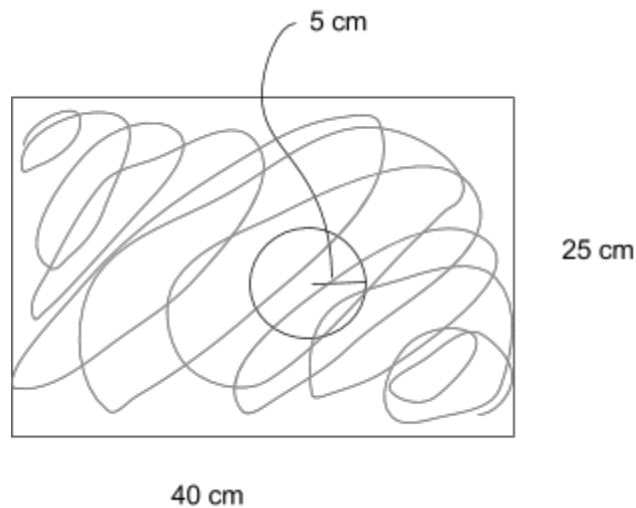
Therefore, from our calculation before.

$A_{Top} = A_{Bottom} = 1000\ cm^2$
$A_{Top\ and\ Bottom} = 2000\ cm^2$

Surface area for the rectangular prism is the sum of all faces.

$$
\begin{aligned}
SA\ &=\ A_{front\ and\ back} + A_{top\ and\ bottom} + A_{sides}\\
&=\ 800 + 2000 + 500\\
&=\ 3300\ cm^2
\end{aligned}
$$

Step 2
Calculate the surface area of the cylinder.

Top of the Cylinder
Remember! We've already calculated this as it is included in the surface area of the rectangle.

Bottom of the cylinder is a common area, not part of the surface area of the composite object. Again, no need to calculate.

Side of the cylinder (rectangle)

Circumference of the
Circle = 2 x pi x r

10 cm

10 cm
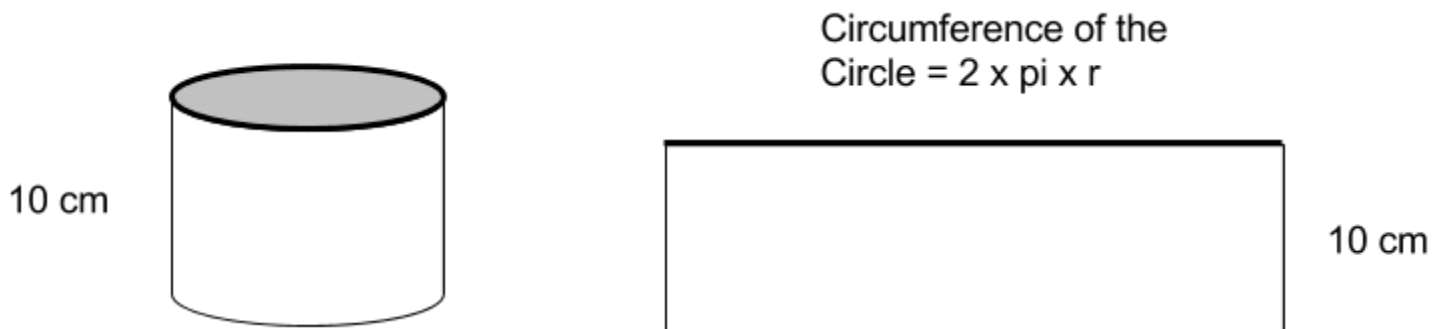
$$
\begin{aligned}
A_{side}\ &=\ h\ x\ 2\pi r\\
&=\ 10\ x\ 2\pi\ x\ 5\\
&=\ 314\ cm^2 = SA_{cylinder}
\end{aligned}
$$

Step 3
Calculate the surface area of the composite object.

$$
\begin{aligned}
SA\ &=\ SA_{rectagular\ prism} + SA_{cylinder}\\
&=\ 3300 + 314\\
&=\ 3614\ cm^2
\end{aligned}
$$