

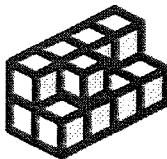
1.3 Surface Area



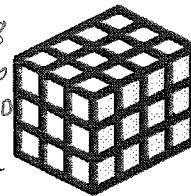
➤ Surface Area is the sum of the areas of all the faces (sides) of a 3-D Object.

1) In the following diagrams how many pieces have :

- a) 4 faces showing? - white 5
- b) 3 faces showing? - orange - 4
- c) 2 faces showing? - black - 4
- d) 1 faces showing? - ○



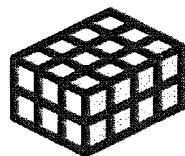
- a) 3 faces showing? - pink 8
- b) 2 faces showing? - yellow 16
- c) 1 faces showing? - green 10
- d) No faces showing? - inside 2



$$\begin{aligned}
 & 18 \times 9 + 2 \times 18 \times 3 + 3 \times 9 \\
 & = (10 + 32 + 24) \\
 & = 66
 \end{aligned}$$

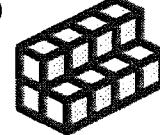
1) Determine the surface area of the composite of cubes. Each cube has sides of 1 unit. - so area of $1 \times 1 = 1$

a)



$$\begin{aligned}
 \text{top/bottom} &= 2 \times 12 \\
 \text{ends} &= 2 \times 6 \\
 \text{side} &= 2 \times 8 \\
 &\hline 52
 \end{aligned}$$

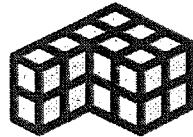
b)



$$\begin{aligned}
 \text{top/bottom} &= 2 \times 8 \\
 \text{ends} &= 2 \times 3 \\
 \text{side} &= 2 \times 8 \\
 &\hline 38
 \end{aligned}$$

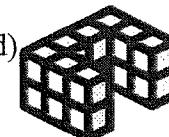
* Notice: you can raise the rows in your imagination so top = bottom

c)



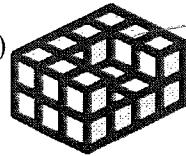
$$\begin{aligned}
 \text{top} \times 2 &= 2 \times 8 \\
 \text{side} &= 2 \times 8 \\
 \text{ends} &= 2 \times 6 \\
 &\hline 44
 \end{aligned}$$

d)



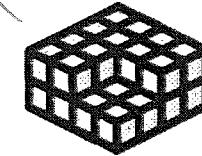
$$\begin{aligned}
 & 2 \times 8 \\
 & 8 \\
 & 2 \times 6 \\
 & 2 \times 8 \\
 &\hline 52
 \end{aligned}$$

e)



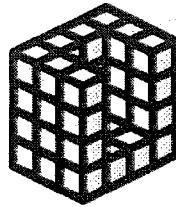
$$\begin{aligned}
 & 2 \times 12 \\
 & 12 \\
 & \text{top/bottom} \\
 & \text{inside} \\
 & 2 \times 8 \\
 & 2 \times 6 \\
 &\hline 56
 \end{aligned}$$

f)



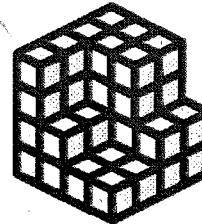
$$\begin{aligned}
 & 2 \times 16 \\
 & 8 \\
 & 2 \times 8 \\
 & 2 \times 8 \\
 &\hline 64
 \end{aligned}$$

g)



$$\begin{aligned}
 & \text{top/bott} \\
 & \text{inside} \\
 & 12 \\
 & \text{side} \\
 & 2 \times 16 \\
 & \text{ends} \\
 & 2 \times 12 \\
 &\hline 92
 \end{aligned}$$

h)

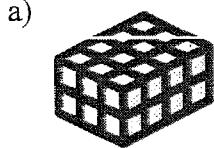


$$\begin{aligned}
 & \text{top/bott} \\
 & 2 \times 16 \\
 & 8 \\
 & \text{side} \\
 & 2 \times 14 \\
 & \text{ends} \\
 & 2 \times 16 \\
 &\hline 92
 \end{aligned}$$

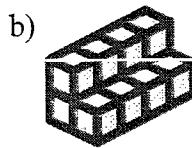
Show
using
cubes

Students
use
cubes
to
help
by
building

2) Determine the surface area of the composite of cubes. Each cube has sides of 2 units. - so area each of $2 \times 2 = 4$

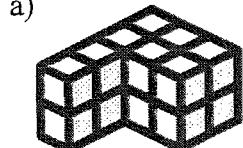


$$\begin{array}{r}
 2 \times 12 \\
 2 \times 8 \\
 2 \times 6 \\
 \hline
 \times 4 \\
 \hline
 208
 \end{array}$$

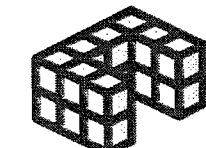


$$\begin{array}{r}
 2 \times 8 \\
 2 \times 8 \\
 2 \times 3 \\
 \hline
 38 \\
 \times 4 \\
 \hline
 152
 \end{array}$$

3) Determine the surface area of the composite of cubes. Each cube has sides of 3 units. - So area of $3 \times 3 = 9$

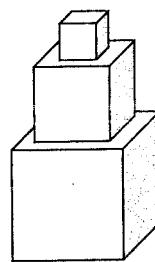
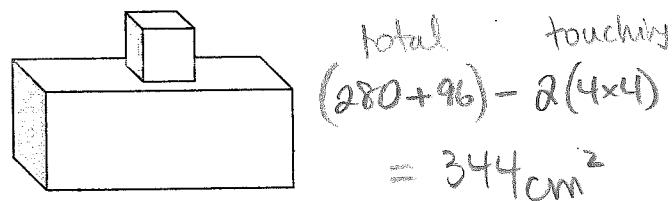
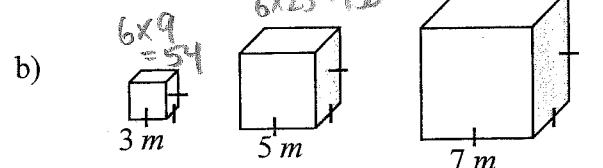
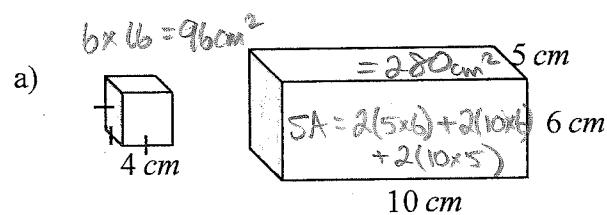


$$\begin{array}{r}
 248 \\
 \times 8 \\
 \hline
 246 \\
 \times 9 \\
 \hline
 396
 \end{array}$$



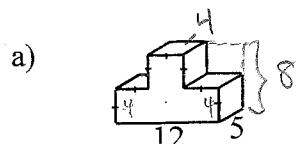
$$\begin{array}{r}
 2 \times 8 \\
 2 \times 8 \\
 2 \times 6 \\
 + 8 \\
 \hline
 52 \\
 \times 9 \\
 \hline
 468
 \end{array}$$

5) Determine the **total surface area** when the prisms are combined to form the composite object shown.



$$(294 + 150 + 54) - 2(25) - 2(9) = 430 \text{ m}^2$$

6) Determine the surface area of the composite figures. (all measurements are in cm)



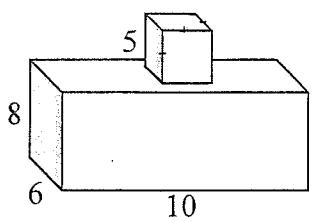
top/bottom 2 (12x5)

front/back $2(4 \times 12 + 4 \times 4)$

ends 2(8x5)

328cm²

b)

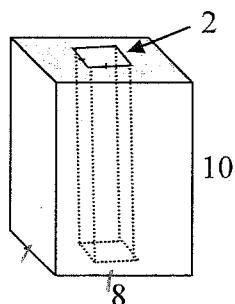


$$\text{large } 2(8 \times 6) + 2(8 \times 10) + 2(6 \times 10)$$

$$\text{small } + 6(5 \times 5) - 2(5 \times 5) \text{ overlap}$$

$$= \underline{476 \text{ cm}^2}$$

c)

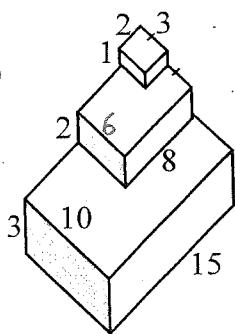


$$2(8 \times 8) + 2(8 \times 10) + 2(8 \times 10)$$

$$- 2(2 \times 2) + 4(2 \times 10)$$

$$= \underline{520 \text{ cm}^2}$$

d)



$$2(3 \times 10) + 2(3 \times 15) + 2(10 \times 15)$$

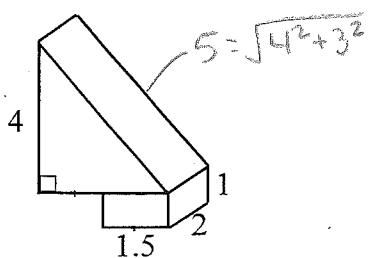
$$+ 2(2 \times 6) + 2(2 \times 8) + 2(6 \times 8)$$

$$+ 2(1 \times 2) + 2(2 \times 3) + 2(1 \times 3)$$

$$- 2(2 \times 3) - 2(6 \times 8) - 2(10 \times 15)$$

$$= \underline{216 \text{ cm}^2}$$

e)



$$\square 2\left(\frac{1}{2} \times 3 \times 4\right) + 2(4 \times 2) + (2 \times 5) + (2 \times 3)$$

$$\square + 2(1 \times 2) + 2(1.5 \times 1) + 2(2 \times 1.5)$$

$$\text{overlap } - 2(1.5 \times 2)$$

$$= \underline{43 \text{ cm}^2}$$

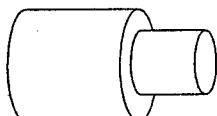
area = $2(18 \times 5) + 2(5 \times 5) + 2(13 \times 5)$
 triangle + $2(\frac{1}{2}5 \times 2) + (12 \times 5) + (5 \times 5) + (13 \times 5)$
 overlap - $2(13 \times 5)$
 $= 490 \text{ cm}^2$

7) Determine the total area of overlap when the cylinders are combined to form the composite object shown.

a)

$$H = 4$$

$$H = 6$$

$$\text{overlap} = 2(\pi(3)^2) = 18\pi \\ = 56.5$$

b)

$$\begin{array}{c} \text{cylinder} \\ r=4 \\ H=2 \end{array}$$

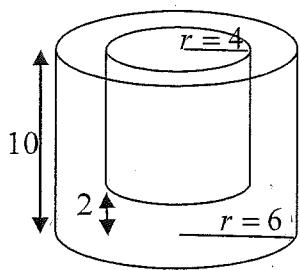
A diagram showing a large cylinder at the bottom, with a smaller cylinder placed on top of it. This represents the concept of a cylinder on a cylinder.

$$\begin{array}{c} \text{cylinder} \\ r=4 \\ H=2 \end{array}$$

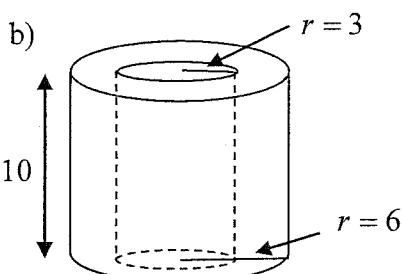
$$\text{overlap} = 2(\pi \times 0.5^2) + 2(\pi \times 2.5^2) \\ = 13\pi \\ \approx \underline{\underline{40.8}}$$

8) Determine the surface area of the composite figures. (all measurements are in cm)

a)

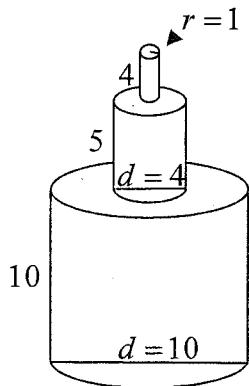


$$\begin{aligned}
 & \text{Outside side} & 10\pi \times 12 & \text{10=h} \\
 & + & \pi \times 12 \text{-circumf} \\
 & \text{inside side} & 8\pi \times 8 & \\
 & + & \\
 & \text{bottom} & \pi(6)^2 & \\
 & + & \\
 & \text{top ring} & \pi(6^2) - \pi(4^2) & = 240\pi \text{ cm}^2 \\
 & & = 754 \text{ cm}^2
 \end{aligned}$$



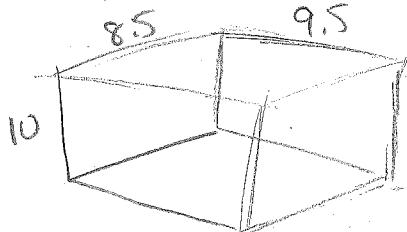
$$\begin{aligned}
 & \text{circumf.} \\
 & \text{d} \\
 & \text{outside side} & 10 \times \pi \times 12 & = 120\pi \\
 & \text{inside side} & 10 \times \pi \times 6 & = 60\pi \\
 & \text{top/bottom ring} & 2(\pi \times 6^2 - \pi \times 3^2) & = (72 - 18)\pi \\
 & & = 234\pi \text{ cm}^2 & \leftarrow \text{in terms of } \pi \\
 & & = 735 \text{ cm}^2
 \end{aligned}$$

c)



$$\begin{aligned}
 & \text{top side} + \text{top top} + \text{top bottom} - \cancel{2(\text{top bottom})} \\
 & + \text{mid side} + \cancel{2(\text{mid top})} - \cancel{2(\text{mid top})} \\
 & + \text{bottom side} + \cancel{2(\text{bottom top})} \\
 & = 4 \times \pi \times 2 + 5 \times \pi \times 4 + 10 \times \pi \times 10 + 2(\pi \times 5^2) \\
 & = 178\pi \text{ cm}^2 \\
 & = 559.2 \text{ cm}^2
 \end{aligned}$$

9) A bedroom with a rectangular shaped floor has a length of 8.5 feet, a width 9.5 feet and a height of 10 feet. It has one rectangular shaped door with dimensions 3 feet by 7 feet. Assuming there are no windows, find the surface area of the walls and ceilings. If one can of paint covers 175 feet squared, and you need to apply 2 coats of paint, how many cans of paint are required to paint the room?

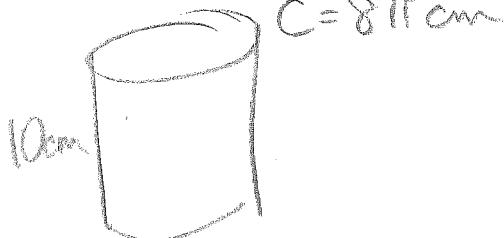


$$\begin{aligned}
 & \text{ceiling } 8.5 \times 9.5 \\
 & + \text{Walls } 2(10 \times 8.5) + 2(10 \times 9.5) \\
 & \text{door } - 3 \times 7 \\
 & \hline
 & 419.75 \text{ ft}^2
 \end{aligned}$$

$$\frac{419.75 \text{ ft}^2}{175 \text{ ft}^2/\text{can}} = 2.40 \text{ cans}$$

$$\times 2 \text{ coats} = 4.8 \rightarrow 5 \text{ cans}$$

10) A can of peas has a height of 10 cm and a circumference of 8π cm. What amount of paper is needed to make labels for 20 cans of peas?



Labels \rightarrow sides only

$$\begin{aligned}
 & 20 \text{ cans} \times (10 \text{ cm})(8\pi \text{ cm}) \\
 & = 5024 \text{ cm}^2
 \end{aligned}$$