

# 1.3 Surface Area

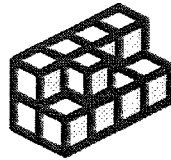
key

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

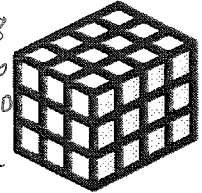
Show using cubes

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? - 0



- a) 3 faces showing? - pink 8
- b) 2 faces showing? - yellow 6
- c) 1 faces showing? - green 10
- d) No faces showing? - 2 inside

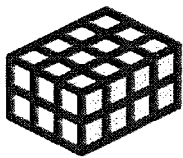


$$1 \times 10 + 2 \times 16 + 3 \times 8 = 10 + 32 + 24 = 66$$

Students use cubes to help by building

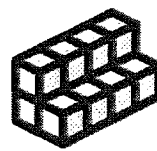
1) Determine the surface area of the composite of cubes. Each cube has sides of 1 unit.

a)



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

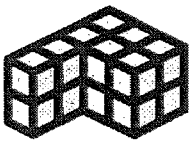
b)



$$\begin{array}{l} \text{top/bott} = 2 \times 8 \\ \text{ends} = 2 \times 3 \\ \text{side} = 2 \times 8 \\ \hline 38 \end{array}$$

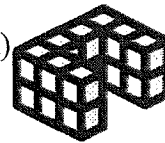
★ Notice: you can raise the rows in your imagination so top = bottom

c)



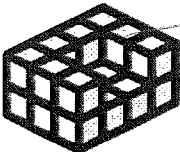
$$\begin{array}{l} \text{top} \times 2 = 2 \times 8 \\ \text{side} = 2 \times 8 \\ \text{ends} = 2 \times 6 \\ \hline 44 \end{array}$$

d)



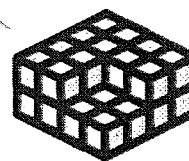
$$\begin{array}{r} 2 \times 8 \\ 8 \\ 2 \times 6 \\ 2 \times 8 \\ \hline 52 \end{array}$$

e)



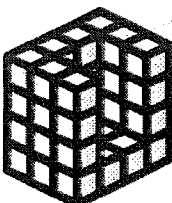
$$\begin{array}{l} 2 \times 12 \text{ top/bottom} \\ 1 \times 4 \text{ inside} \\ 2 \times 8 \text{ sides} \\ 2 \times 6 \text{ ends} \\ \hline 56 \end{array}$$

f)



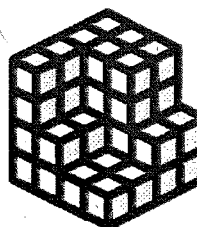
$$\begin{array}{l} 2 \times 16 \text{ top/bot} \\ 2 \times 8 \text{ ends} \\ 2 \times 8 \text{ sides} \\ \hline 64 \end{array}$$

g)



$$\begin{array}{l} \text{top/bott} \quad 2 \times 12 \\ \text{inside} \quad 12 \\ \text{side} \quad 2 \times 16 \\ \text{ends} \quad 2 \times 12 \\ \hline 92 \end{array}$$

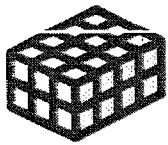
h)



$$\begin{array}{l} \text{top/bott} \quad 2 \times 16 \\ \text{side} \quad 2 \times 14 \\ \text{ends} \quad 2 \times 16 \\ \hline 92 \end{array}$$

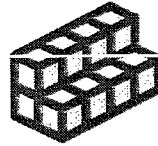
2) Determine the surface area of the composite of cubes. Each cube has sides of 2 units. - so area each of  $2 \times 2 = 4$

a)



$$\begin{array}{r} 2 \times 12 \\ 2 \times 8 \\ 2 \times 6 \\ \hline 52 \\ \times 4 \\ \hline 208 \end{array}$$

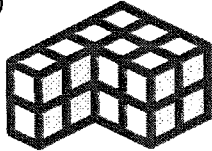
b)



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

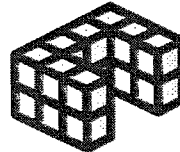
3) Determine the surface area of the composite of cubes. Each cube has sides of 3 units. - so area of  $3 \times 3 = 9$

a)



$$\begin{array}{r} 2 \times 8 \\ 2 \times 8 \\ 2 \times 6 \\ \hline 44 \\ \times 9 \\ \hline 396 \end{array}$$

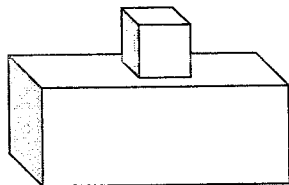
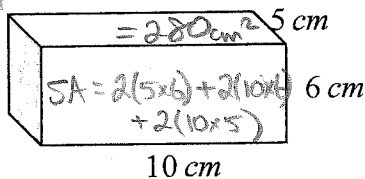
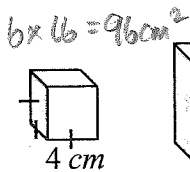
b)



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

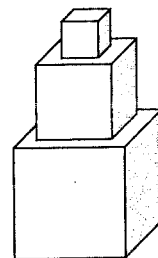
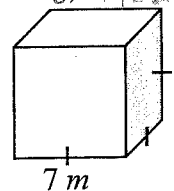
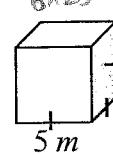
5) Determine the **total surface area** when the prisms are combined to form the composite object shown.

a)



$$\begin{array}{l} \text{total touching} \\ (280 + 96) - 2(4 \times 4) \\ = 344 \text{ cm}^2 \end{array}$$

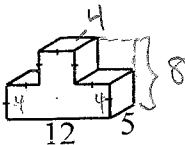
b)



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

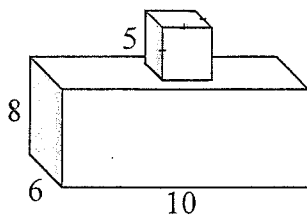
6) Determine the surface area of the composite figures. (all measurements are in cm)

a)



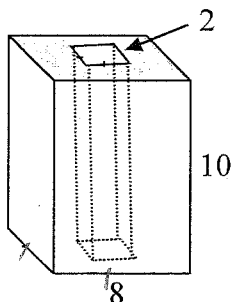
$$\begin{array}{l} \text{top/bottom } 2(12 \times 5) \\ \text{front/back } 2(4 \times 12 + 4 \times 4) \\ \text{ends } 2(8 \times 5) \\ \hline 328 \text{ cm}^2 \end{array}$$

b)



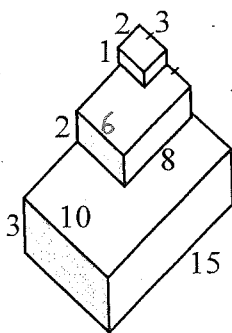
$$\begin{aligned}
 &\text{large } 2(8 \times 6) + 2(8 \times 10) + 2(6 \times 10) \\
 &\text{small } + 6(5 \times 5) - 2(5 \times 5) \quad \text{overlap} \\
 &= \underline{476 \text{ cm}^2}
 \end{aligned}$$

c)



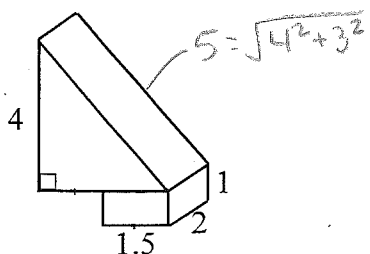
$$\begin{aligned}
 &2(8 \times 8) + 2(8 \times 10) + 2(8 \times 2) \\
 &- 2(2 \times 2) + 4(2 \times 10) \\
 &= \underline{520 \text{ cm}^2}
 \end{aligned}$$

d)



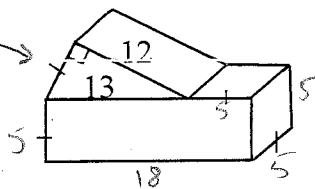
$$\begin{aligned}
 &2(3 \times 10) + 2(3 \times 15) + 2(10 \times 15) \\
 &+ 2(2 \times 6) + 2(2 \times 8) + 2(6 \times 8) \\
 &+ 2(1 \times 2) + 2(2 \times 3) + 2(1 \times 3) \\
 &- 2(2 \times 3) - 2(6 \times 8) - 2(10 \times 15) \\
 &= \underline{216 \text{ cm}^2}
 \end{aligned}$$

e)



$$\begin{aligned}
 &\Delta \quad 2\left(\frac{1}{2} \times 3 \times 4\right) + 2(4 \times 2) + 2(2 \times 5) + 2(2 \times 3) \\
 &\square \quad + 2(1 \times 2) + 2(1.5 \times 1) + 2(2 \times 1.5) \\
 &\text{overlap } - 2(1.5 \times 2) \\
 &= \underline{43 \text{ cm}^2}
 \end{aligned}$$

$$5 = \sqrt{13^2 - 12^2}$$



$$\text{rec } 2(18 \times 5) + 2(5 \times 5) + 2(18 \times 5)$$

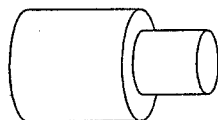
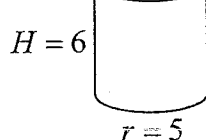
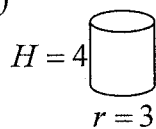
$$\text{triangle} + 2\left(\frac{1}{2} 5 \times 12\right) + (12 \times 5) + (5 \times 5) + (13 \times 5)$$

$$\text{overlap} - 2(13 \times 5)$$

$$= \underline{\underline{490 \text{ cm}^2}}$$

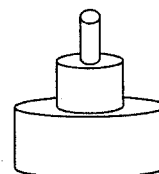
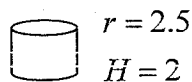
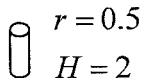
7) Determine the **total area** of overlap when the cylinders are combined to form the composite object shown.

a)



$$\begin{aligned} \text{overlap} &= 2(\pi(3)^2) = 18\pi \\ &= \underline{\underline{56.5}} \end{aligned}$$

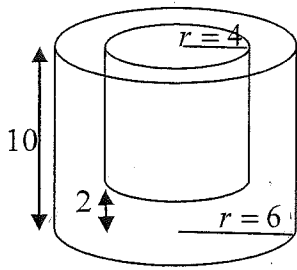
b)



$$\begin{aligned} \text{overlap} &= 2(\pi \times 0.5^2) + 2(\pi \times 2.5^2) \\ &= 13\pi \\ &= \underline{\underline{40.8}} \end{aligned}$$

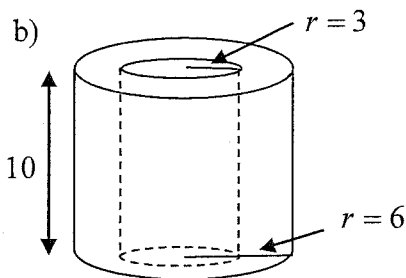
8) Determine the surface area of the composite figures. (all measurements are in cm)

a)



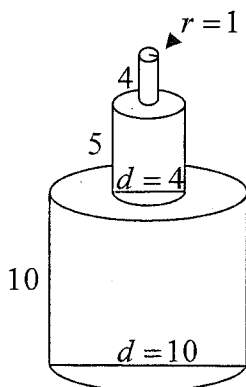
outside side  $10\pi \times 12$   $10=h$   
 $\pi \times 12 = \text{circumf}$   
 +  
 inside side  $8\pi \times 2$   
 +  
 bottom  $\pi(6)^2$   
 +  
 top ring  $\pi(6^2 - 4^2) = 240\pi \text{ cm}^2$   
 $= \underline{754 \text{ cm}^2}$

b)



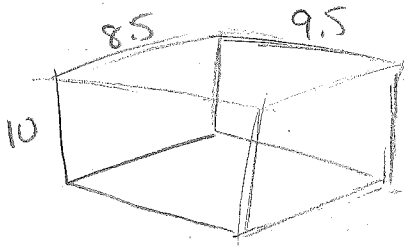
outside side  $10 \times \pi \times 12 = 120\pi$   $\text{circumf.}$   
 inside side  $10 \times \pi \times 6 = 60\pi$   
 top/bottom ring  $2(\pi \times 6^2 - \pi \times 3^2) = (72 - 18)\pi$   
 $= 234\pi \text{ cm}^2 \leftarrow \text{in terms of } \pi$   
 $= \underline{735 \text{ cm}^2}$

c)



top side + ~~top top~~ + ~~top bottom~~ - ~~2(top bottom)~~  
 + mid side + ~~2(mid top)~~ - ~~2(mid top)~~  
 + bottom side + ~~2(bottom top)~~  
 $= 4 \times \pi \times 2 + 5 \times \pi \times 4 + 10 \times \pi \times 10 + 2(\pi \times 5^2)$   
 $= 178\pi \text{ cm}^2$   
 $= \underline{559.2 \text{ cm}^2}$

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?

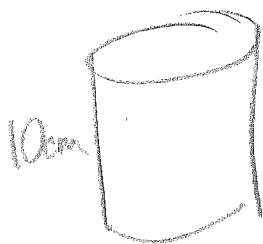


$$\begin{array}{rcl}
 \text{ceiling} & 8.5 \times 9.5 & \\
 + \text{Walls} & 2(10 \times 8.5) + 2(10 \times 9.5) & \\
 \text{door} & - 3 \times 7 & \\
 \hline
 & 419.75 \text{ ft}^2 &
 \end{array}$$

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

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

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



$$C = 8\pi \text{ cm}$$

labels  $\rightarrow$  sides only

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