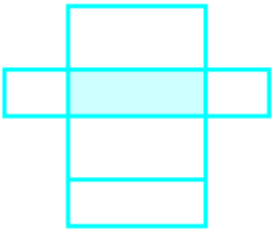
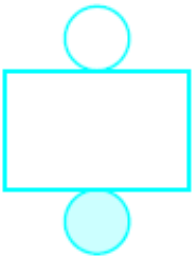
Surface Area of Solids

Nets of Solids

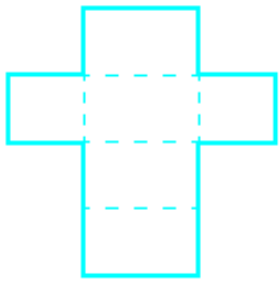
A net is the flat shape obtained when you "unwrap" a solid. Looking at the net of a solid helps find the surface area of a solid. Below are the nets of three solids.

Solid	Net
Rectangular prism 	6 faces (all rectangles) 
Cylinder 	3 faces (1 rectangle and 2 circles) 
Square pyramid 	5 faces (1 square and 4 triangles) 

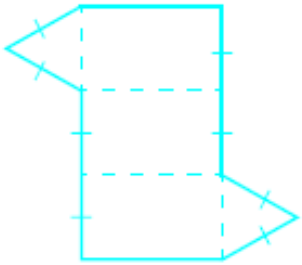
Exercise 1

- Using the graph paper provided draw these nets on grid paper, then cut and fold b), and at least one of the other nets to form solids. Name the solids you have made.
- To find the total surface area we need to add the areas of each of the faces.
- Find the surface area of the examples below.

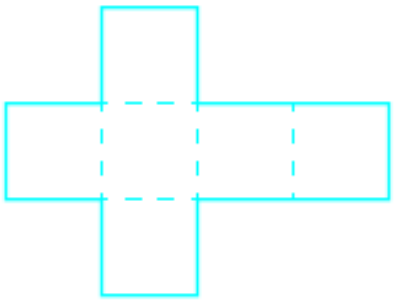
a)



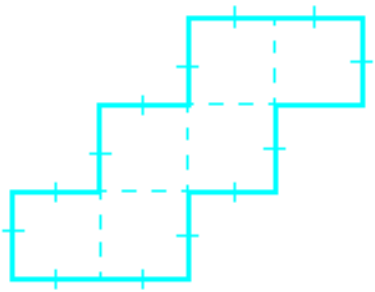
b)



c)

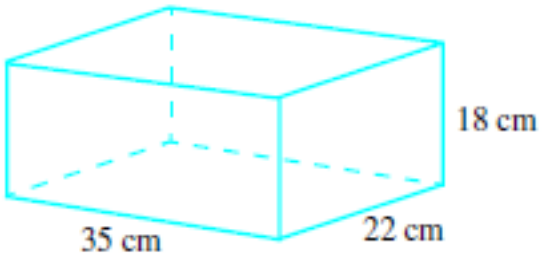


d)



Example 1

A box measures 35 cm by 22 cm by 18 cm. How much cardboard is needed to make the box (without overlapping flaps)?



Solution

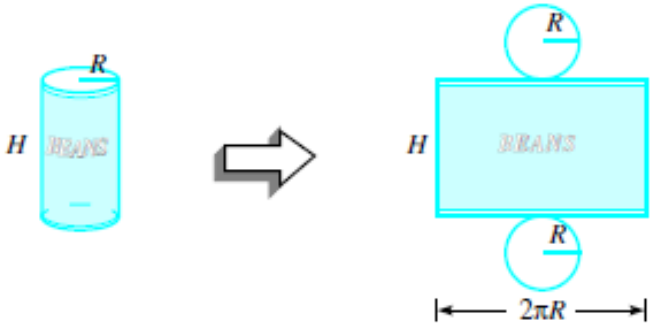
The box has six rectangular faces, so we find the sum of the areas of the six rectangles.
A = (35 × 18) + (35 × 18) + (22 × 18) + (22 × 18) + (35 × 22) + (35 × 22)
= 2(35 × 18) + 2(22 × 18) + 2(35 × 22)
= 3592 cm^2

The amount of cardboard needed to make the box is 3592 cm^2.

Note that there are actually three pairs of rectangles.

Cylinders

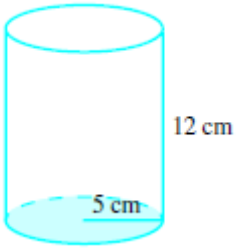
An unopened can of beans has three faces. The top and bottom of the can are circles with radius R. The curved surface is a rectangle with length equal to the circumference ($2\pi R$) of the circle and width equal to the height H of the can.



Each circle has an area of πr^2 and the curved surface of the cylinder has an area of $2\pi rH$.

Example 2

Find the surface area (to 2 decimal places) of a closed cylinder with base radius 5 cm and height 12 cm.



Solution

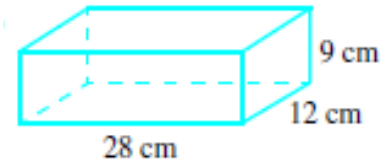
The cylinder has three faces (two circles and a rectangle).
$A = \pi r^2 + \pi r^2 + 2\pi rh$
$= 2\pi r^2 + 2\pi rh$
= (2 × π × 25) + (2 × π × 5 × 12)
≈ 534.07 cm^2

The surface area is about 534 cm^2.

Exercise 2

Find the surface areas of the closed solids.

Q1.



a) How many faces are there?

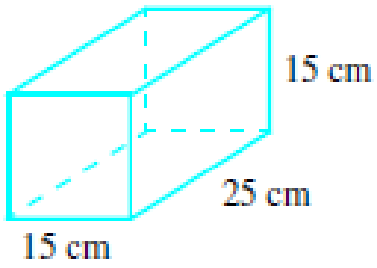
b) Area of rectangle “1”:

Area of rectangle “2”:

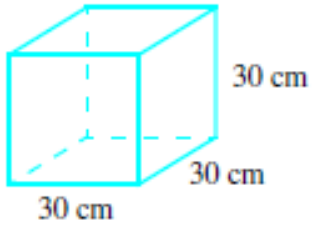
Area of rectangle “3”:

c) The total surface area:

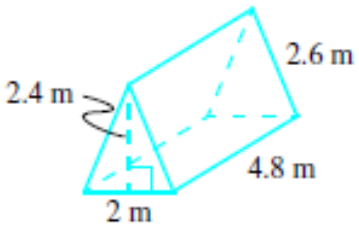
Q2. Use the steps from Q1 to find the area of this rectangular prism:



Q3. Calculate the surface area of the cube below:



Q4.



a) How many triangular faces are there?

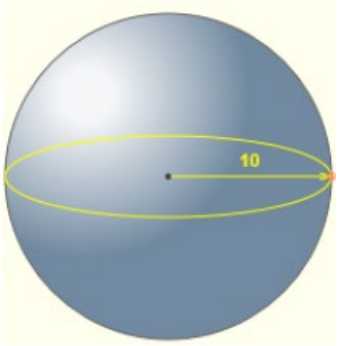
b) What is the area of each triangle?

c) How many rectangular faces are there?

d) What is the area of the rectangles? Note that all the rectangles are not the same size.

e) Use your results to find the total surface area of the trianglar prism.

Surface Areas of Spheres



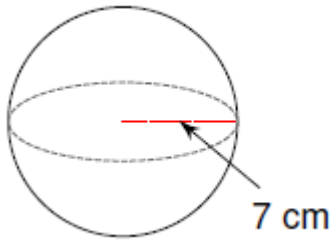
A sphere is a circular solid. For a given volume, the sphere is the shape that has the smallest surface area. The sphere appears in nature; such as water drops, bubbles and planets.

The surface area of a sphere is exactly four times the area of a circle with the same radius. Since the area of a circle is πr^2 the surface area of a sphere is $4\pi r^2$.

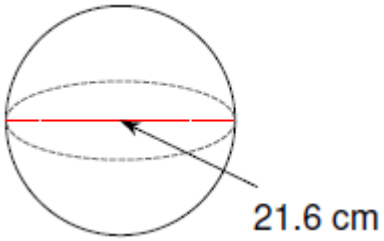
Example
The surface area of the above sphere is $4 \times \pi \times r^2 = 4 \times \pi \times 10^2 = 1256.6$ cm^2

Exercise 3
Find the surface area of the following spheres and hemispheres.

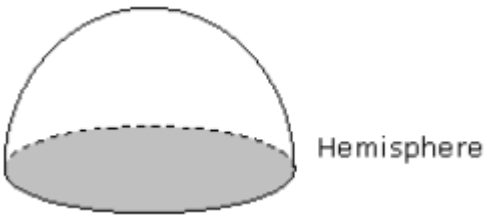
Q1. a)



b)

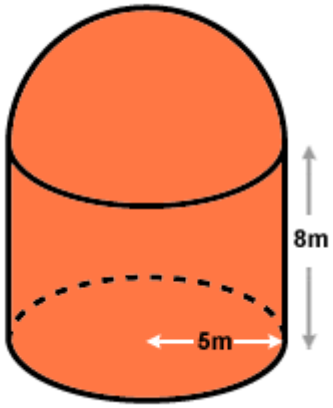


c) The surface area formula for the "closed" hemisphere is $3 \times \pi \times r^2$
So, the surface area formula for an "open" hemisphere is ? $\times \pi \times r^2$

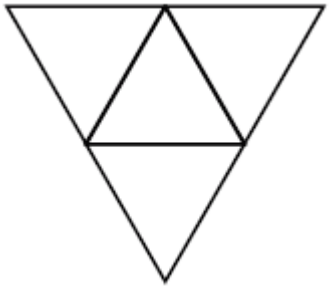


r = 5 cm

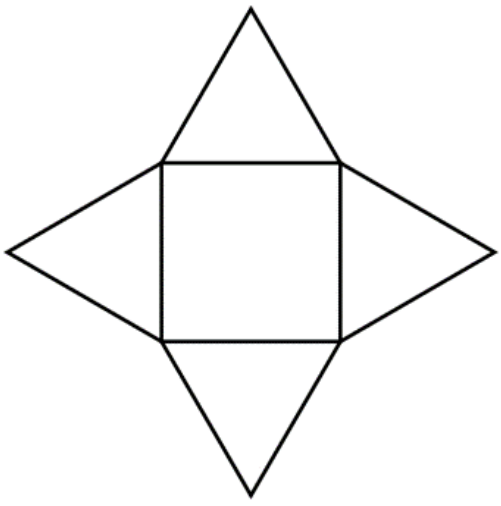
Q2. Find the surface area of this compound shape.



Q3. Consider the net below. Name the solid it forms. Draw a sketch of this solid. Explain how you would find its surface area. What dimensions are required?



Q4. . Consider the net below. Name the solid it forms. Draw a sketch of this solid. Explain how you would find its surface area. What dimensions are required?



INVESTIGATION WEEK 3

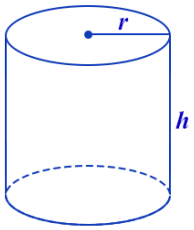
On a separate piece of paper, choose ONE of the following tasks to complete

1. Find an example of a common every day item that is a rectangular prism.

- Name your chosen item (e.g. tissue box, box of cereal, book, mattress, etc) and draw a neat diagram or provide a photo image (this will need to be printed and included in your investigation)
- Find the length, width and height of your item to the nearest centimetre – state these dimensions clearly
- Draw the net of this rectangular prism; include the dimensions on your diagram.
- Find the surface area of your chosen prism; show working

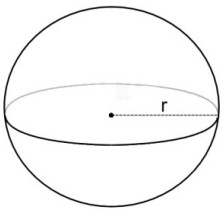
2. Find an example of a common every day item that is cylindrical in shape

- Name your chosen item (e.g. can of drink, tin of food, etc) and draw a neat diagram or provide a photo image (this will need to be printed and included in your investigation)
- Find the radius and height of your item to the nearest centimetre – state these dimensions clearly
- Draw the net of this cylinder; include the dimensions on your diagram.
- Find the surface area of your chosen prism; show working



3. Find an example of a common every day item that is spherical in shape

- Name your chosen item (e.g. tow bar ball, netball, stress ball, cricket ball, basketball, tennis ball etc) and draw a neat diagram or provide a photo image (this will need to be printed and included in your investigation)
- Find the radius of your item to the nearest centimetre – state these dimensions clearly on your diagram
- Find the surface area of your chosen prism; show working



4. Choose your own solid and discuss your choice with your teacher.

Working out: