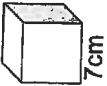
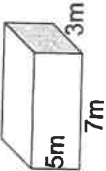
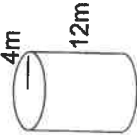


Week 23: Measurements of 3-Dimensional Shapes

Total Surface Area

- All the sides must have the same units before you use it in a calculation.
- The answer is an area, therefore the unit is mm², cm², m², km², etc.

Name of prism	Formulas and examples
Cube 	$TSA = 6 \times \text{side}^2$ $TSA = 6 \times \text{side}^2$ $= 6 \times 7^2$ $= 294 \text{ cm}^2$
Rectangular prism 	$TSA = 2 \times (B \times L) + 2 \times (B \times H) + 2 \times (L \times H)$ $TSA = 2 \times (B \times L) + 2 \times (B \times H) + 2 \times (L \times H)$ $= 2 \times (3 \times 7) + 2 \times (3 \times 5) + 2 \times (7 \times 5)$ $= 142 \text{ m}^2$
Cylinder 	$TSA = 2 \times (\pi \times r^2) + (2 \times \pi \times r) \times H$ $TSA = 2 \times (\pi \times r^2) + (2 \times \pi \times r) \times H$ $= 2 \times (3,142 \times 4^2) + (2 \times 3,142 \times 4) \times 12$ $\approx 402,11 \text{ cm}^2$

Exercise I: Total Surface Area

Calculate the TSA of each figure. Unless stated otherwise round your answer to two decimal places where applicable. Use $\pi = 3,142$.

* Formulae to be as given in CAPS

Surface area of rectangular box = $2 \times (l \times w) + 2 \times (l \times h) + 2 \times (w \times h)$

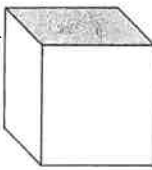
l = length; w = width; h = height

Surface area of cylinder (closed lid and base) = $(2 \times \pi \times [\text{radius}]^2) + (2 \times \pi \times \text{radius} \times \text{height})$

*remember: a cube is also a rectangular prism!

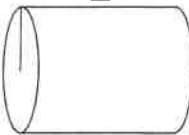
Calculate the total surface area of each figure.

1. Cube with one side = 15,62cm



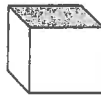
5.

$r = 1,045\text{m}$



$H = 2,79\text{m}$

2. Cube with one side = 3,765mm



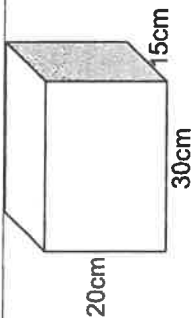
6.

$d = 15,67\text{cm}$



$H = 7,5\text{cm}$

3.



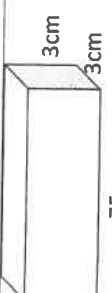
7. Calculate the total surface area of the following tin of peas.




$r = 3,85\text{cm}$

Peas

$H = 11,9\text{cm}$

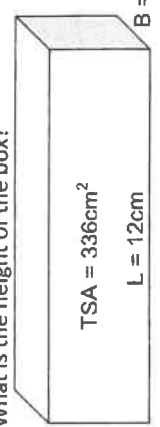
4.  Give your answer in cm^2 .

8. A certain cereal box has the following dimensions: 28,5 cm by 24 cm by 7 cm. How much cardboard is needed to make this box? 

Exercise J: Total Surface Area

- Round all final answers to 2 decimal places and use $\pi = 3,142$.
- This slice of cake is an eighth of a circle. The radius is 92 mm and the height 7,5 cm. Calculate its total surface area in mm^2 .
Use the formula: TSA of an eighth of a cylinder
 $= (2 \times \frac{1}{8} \times \pi \times r^2) + 2(r \times H) + (\frac{1}{8} \times 2 \times \pi \times r \times H)$
 - Calculate the total surface area of this gift box. The base is a square with each side equal to 10 cm and the height is 14,75 cm.
TSA of rectangular prism = $2(B \times L) + 2(B \times H) + 2(L \times H)$
 - A certain cube has sides that are 5 cm long and a certain rectangular prism have sides that are 3 cm, 5 cm and 7 cm long.
Formulae: TSA of cube = $6 \times \text{side}$
TSA of rectangular prism = $2(B \times L) + 2(B \times H) + 2(L \times H)$
 - Which prism has the largest total surface area?
 - How much larger is the one prism than the other one?
 - A certain rectangular box has a length that is three times as long as its breadth. The height is twice as long as the breadth. Make a drawing of the box and determine its total surface area if the breadth is 5 cm.
TSA of rectangular prism = $2(B \times L) + 2(B \times H) + 2(L \times H)$
 - The total surface area of a certain cube is 486 cm^2 . How long is each side?
TSA of cube = $6 \times \text{side}$

6.* A rectangular box has a total surface area of 336 cm^2 . Its length is 12cm and the breadth = 7cm. What is the height of the box?



TSA = 336 cm^2
L = 12cm
B = 7cm
H = ?

Formula: TSA of rectangular prism = $2(B \times L) + 2(B \times H) + 2(L \times H)$

7.* The total surface area of a rectangular prism with breadth of 4 cm and a length of 5 cm is 184 cm^2 . Calculate the height of the rectangular prism.

8.* What is the total surface area of a cube if one face of this cube has an area of 144 mm^2 ?
Formula: TSA of cube = $6 \times \text{side}^2$



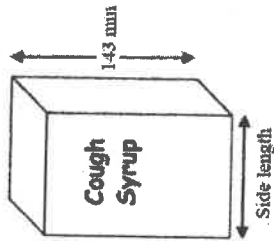
#Exercise K: Total Surface Area – Vicks Exercise (NB!!)

Round all final answers to 2 decimal places and use $\pi = 3,142$.

From: NSC November Exam 2010, Paper 2

Triggers Enterprises was awarded the tender for making rectangular cardboard boxes to package bottles of cough syrup. Each bottle is packed in a cardboard box with a square base, as shown below.

- The diameter of the base of the bottle is 58 mm and the height of the box is 143 mm.
- The length of the side of the base of the box must be approximately 105% of the diameter of the base of the bottle.
- The height of the box is approximately 102% of the height of the bottle.



The following formulae may be used:

Area of circle = $\pi \times (\text{radius})^2$, and using $\pi = 3,14$

Area of square = (side length)²

Area of rectangle = length \times breadth

Area of opened cardboard box = $4(A + D) + 2(B + C) + E$

(See design of open cardboard box in QUESTION 4.3)

The following conversions may be useful:

$1 \text{ cm}^2 = 100 \text{ mm}^2$

$1 \text{ m}^2 = 10\,000 \text{ cm}^2$

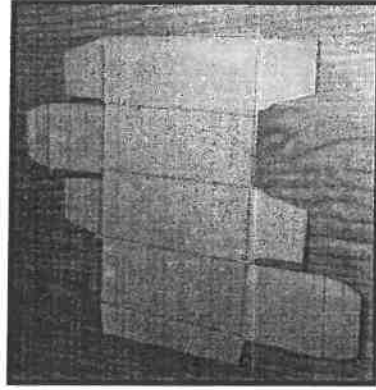
1. Calculate the height of the bottle to the nearest millimetre. (3)

2. In order to minimise the cost of cardboard required for the box, the following guideline is used: The difference between the areas of the base of the cardboard box and the base of the bottle should not be more than 11 cm^2 .

Determine whether the dimensions of the cardboard box satisfy the above guideline. Show ALL appropriate calculations. (11)

To ensure that the box is strong enough, the cardboard used for the box has a mass of $240 \text{ grams per m}^2$ (g/m^2).

The layout of the opened cardboard box is shown below.



Picture of opened box

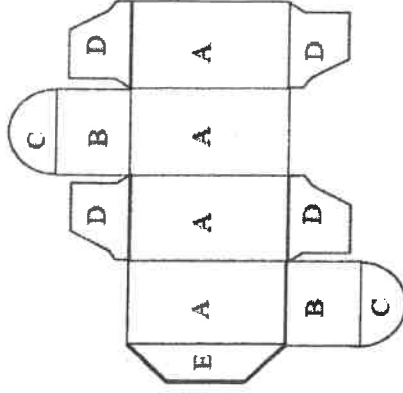


Diagram of layout of opened box

- Section C is semicircular.
- The area of each section D = $1\,832 \text{ mm}^2$.
- The area of section E = $2\,855 \text{ mm}^2$.

3. Calculate the total mass of the cardboard needed for one box, to the nearest gram. (11)
4. The total cost of the cough syrup includes the cost of the cardboard box. Use the following formula to calculate the cost of the boxed bottle of cough syrup:
Total cost = $R16 + (\text{mass of cardboard box}) \times R20,00 \text{ per kg}$ (3)

