Metric System Conversions

Mass (g = gram)

$$\mathbf{Kg} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{hg} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{dag} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{g} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{dg} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{cg} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{mg}$$

Distance or Length (m = metre)

$$\mathbf{Km} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{hm} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{dam} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{m} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{dm} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{cm} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{mm}$$

Area (m^2 = square metre)

$$\mathbf{Km^2} \underset{\div 100}{\overset{\times 100}{\rightleftarrows}} \mathbf{hm^2} \underset{\div 100}{\overset{\times 100}{\rightleftarrows}} \mathbf{dam^2} \underset{\div 100}{\overset{\times 100}{\rightleftarrows}} \mathbf{m^2} \underset{\div 100}{\overset{\times 100}{\rightleftarrows}} \mathbf{dm^2} \underset{\div 100}{\overset{\times 100}{\rightleftarrows}} \mathbf{cm^2} \underset{\div 100}{\overset{\times 100}{\rightleftarrows}} \mathbf{mm^2}$$

Volume (m^3 = cubic metre)

$$\mathbf{Km^3} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \mathbf{hm^3} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \mathbf{dam^3} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \mathbf{m^3} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \mathbf{dm^3} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \mathbf{cm^3} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \mathbf{mm^3}$$

Capacity (l = litre)

$$\mathbf{kl} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{hl} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{dal} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{l} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{dl} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{cl} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \mathbf{ml}$$

volume vs capacity

1 m^3 = 1 kl

1 dm^3 = 1 l

1 cm^3 = 1 ml

6.1- A- Areas of Prisms and Cylinders

For every solid we can find two types of areas:

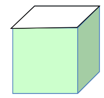
- Lateral area (A_L): area of lateral faces-no base(s)
- Total area (A_T): area of lateral faces and base(s)

Formulas:

	A_L (Lateral Area)	$A_T = A_L + 2A_b$ (Total Area)
Cubes	$4w^2$	$6w^2$
Prisms	P_bh	$P_bh + 2A_b$
Cylinders	$2\pi rh$ or πdh	$2\pi rh + 2\pi r^2$

	A_L (Lateral Area)	$A_T = A_L + 2A_b$ (Area total)
Cubes	$4w^2$	$6w^2$

Ex 1: Find the total area

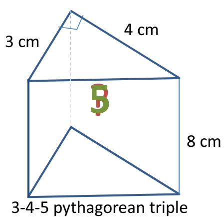


3 cm

	A_L (Lateral Area)	$A_T = A_L + 2A_b$ (Area total)
Prisms	P_bh	$P_bh + 2A_b$

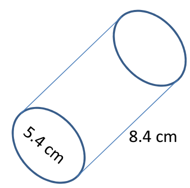
Ex 2: Page 178 # 4)

$A_T = P_bh + 2A_b$



	A_L (Lateral Area)	$A_T = A_L + 2A_b$ (Area total)
Cylinders	$2\pi rh$ or πdh	$2\pi rh + 2\pi r^2$

Ex 3: P.181 # 14b)



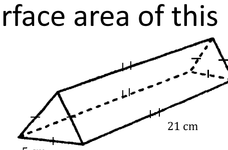
If d = 5.4 cm
Then r = 2.7 cm

Practice: page 178 # 5,8,9,10
page 181 # 14

	A_L (Lateral Area)	$A_T = A_L + 2A_b$ (Area total)
Prisms	P_bh	$P_bh + 2A_b$

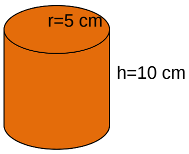
Ex 4: Find the total surface area of this prism

$A_T = P_bh + 2A_b$



	A_L (Lateral Area)	$A_T = A_L + 2A_b$ (Area total)
Cylinders	$2\pi rh$ or πdh	$2\pi rh + 2\pi r^2$

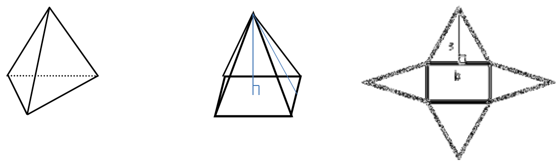
Ex 5: Find the total surface area of the cylinder



$$A_T = 2\pi rh + 2\pi r^2$$

Do and Hand in:
page 179 # 11,13
page 181 # 15,16,17

6.1- B- Pyramids

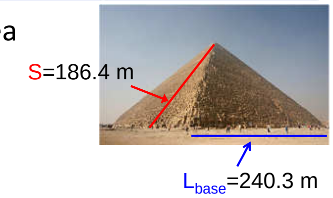


Formula:

	A_L (Lateral Area)	$A_T = A_L + A_b$ (Area total)
Pyramid	$\frac{P_b s}{2}$	$\frac{P_b s}{2} + A_b$

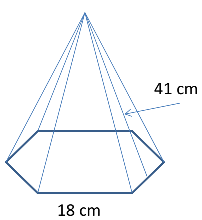
	A_L (Lateral Area)	$A_T = A_L + A_b$ (Area total)
Pyramid	$\frac{P_b s}{2}$	$\frac{P_b s}{2} + A_b$

Ex 1: Find the surface area of the pyramid of Giza.



	A_L (Lateral Area)	$A_T = A_L + A_b$ (Area total)
Pyramid	$\frac{P_b s}{2}$	$\frac{P_b s}{2} + A_b$

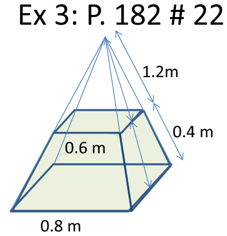
Ex 2: P. 182 # 18c)



	A_L (Lateral Area)	$A_T = A_L + A_b$ (Area total)
Pyramid	$\frac{P_b s}{2}$	$\frac{P_b s}{2} + A_b$

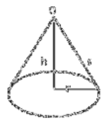
Ex 3: P. 182 # 22

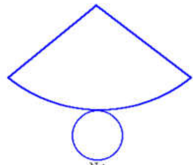
$A_T = A_{L\text{ BIG PYR}} - A_{L\text{ Small pyr}} + A_{\text{upper base}}$



Practice:
page 182 # 18, 20, 21, 23,24,25

6.1 –C- Cones



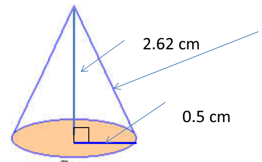


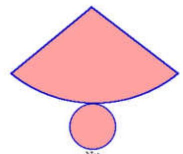
Formula:

	A_L (Lateral Area)	$A_T = A_L + A_b$ (Area total)
Cone	πrs	$\pi rs + \pi r^2$

	A_L (Lateral Area)	$A_T = A_L + A_b$ (Area total)
Cone	πrs	$\pi rs + \pi r^2$

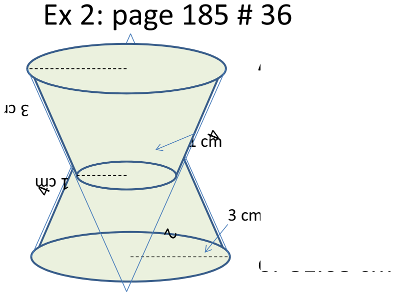
Ex 1: Find the total surface area of the cone.





	A_L (Lateral Area)	$A_T = A_L + A_b$ (Area total)
Cone	πrs	$\pi rs + \pi r^2$

Ex 2: page 185 # 36



Practice: page 184 # 26 to 30

6.1 –D- Spheres

- Formulas:

	A_L (Lateral Area)	$A_T = A_L + A_b$ (Only hemispheres have a base)
Spheres	$4\pi r^2$	
Hemispheres	$2\pi r^2$	$3\pi r^2$

	$A_L = A_T$ Sphere (Lateral Area)	$A_T = A_L + A_b$ (only hemispheres have a base)
	$4\pi r^2$	$2\pi r^2 + \pi r^2$

Ex 1: A Tennis ball has diameter 6 cm. What is its surface area?

6 cm

	$A_L = A_T$ Sphere (Lateral Area)	$A_T = A_L + A_b$ (only hemispheres have a base)
	$4\pi r^2$	$2\pi r^2 + \pi r^2$

Ex 2: A soccer ball with diameter 30 cm is placed tightly inside a cube box. Find the difference between their surface areas.

30 cm

	$A_L = A_T$ Sphere (Lateral Area)	$A_T = A_L + A_b$ (only hemispheres have a base)
	$4\pi r^2$	$2\pi r^2 + \pi r^2$

Ex 3: How many times greater is the SA of the Sun than the Earth?

d_S=1 391 000 km

r = 695500

d_E=12 756 km **r = 6378**

Practice: page 185 # 37 to 42

6.2 Areas of Decomposable solids

Unfamiliar Solids can be broken down into simpler solids so that their area and volume can be calculated more easily.



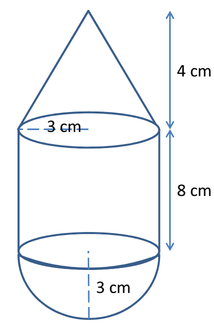

When you have a decomposable solid:

1. Separate and identify the solids involved.
2. Write the formulas for all the areas involved.
3. Calculate them and add them together.
4. Watch out for hidden bases whose areas should not be included.


BASIC FORMULAS

SOLIDS	LATERAL AREA	TOTAL AREA
RIGHT PRISMS	$A_{LAT} = P_B \bullet h$	$A_{TOT} = A_{LAT} + 2A_B$
RIGHT CYLINDERS	$A_{LAT} = 2\pi rh$ $= \pi dh$	$A_{TOT} = 2\pi rh + 2\pi r^2$ $= \pi dh + 2\pi r^2$
RIGHT REGULAR PYRAMIDS	$A_{LAT} = \frac{P_b\, s}{2}$	$A_{TOT} = A_{LAT} + A_b$
RIGHT CONES	$A_{LAT} = \pi rs$	$A_{TOT} = \pi rs + \pi r^2$
SPHERES	$A_{LAT} = A_{TOT} = 4\pi r^2$	
HEMISPHERE	$A_{LAT} = 2\pi r^2$	$A_{TOT} = 3\pi r^2$

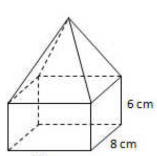
Ex 2: Activity 1 page 187



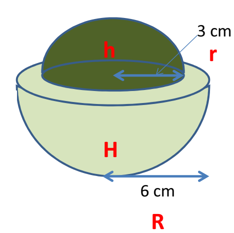
Note the hidden bases between the cone, cylinder, and the hemisphere.

Ex 1:
The solid shown below consists of a rectangular base pyramid joined to a rectangular base prism. The height of each lateral surface of the pyramid is 12 cm, and the prism's dimensions are 10 cm by 8 cm and a height of 6 cm. Find the total surface area.

Note the hidden base between the pyramid and the prism.



Ex 3: p. 189 # 8
A hemisphere is placed on the flat surface of another hemisphere. What is, rounded to the nearest unit, the total area of this solid?



Practice: Page 188 # 2-6,11

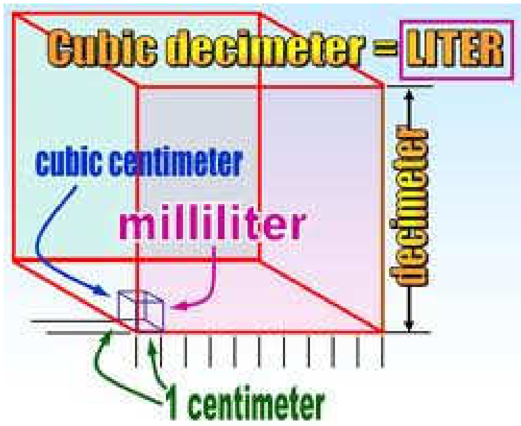
6.3 Volumes of Solids

Volume is the quantity of space that an object occupies

Capacity is the volume of the hollow part of an object.

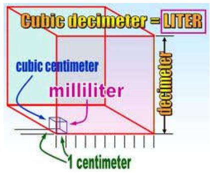
A) The main unit of volume is the cubic meter (m^3). It corresponds to the space enclosed in a cube with edge 1m.

Length (m) $\xrightarrow{\bullet\ m}$ **Area** (m^2) $\xrightarrow{\bullet\ m}$ **Volume** (m^3)



B) The cubic decimetre (dm^3) corresponds to a cube with edge 1 dm (10 cm)

$1\ dm^3 = 1$ litre



1 L of water = 1 kg at standard temperature and pressure

C) $1\ m^3 = 1$ KL

$1\ dm^3 = 1$ L

$1\ cm^3 = 1$ mL

Examples

Convert each of the following:

1. 85 dm^3 =_______________ cm^3

2. 4560 cm^3 = _____________ m^3

3. 0.65 dam^3 = _____________ dm^3

4. 4086 m^3 = ______________ hm^3

5. 0.0169 hm^3 = ______________________ mm^3

Convert each of the following:

6. 1 m^3 = ________________ L

7. 7 dm^3 = ______________ L

8. 2.56 L =_______________ dm^3

9. 0.35 KL = ______________ dm^3

10. 2400 mL =_____________ mm^3

11. 1 cm^3 = __________ dm^3 = __________ L = _________ mL

Practice:
page 190 # 2;
page 192 # 9.

6.3-B- Volume of a Prism

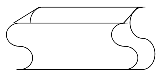
Consider a pack of printer papers. With dimensions:
l = 28 cm; w = 21.5 cm; h = 5 cm.

Area of one paper: A = lw = (28)(21.5) = 602 cm^2

The space this pack occupies (volume):

= (602)(5) = 3010 cm^3

If we shift the pack a little,



the # of papers (height) stays the same and so does the area of each paper.

Therefore the volume stays the same too.

$V_{prism} = A_b \bullet h$

Recall the **AREA** of (some possible bases):

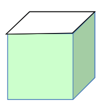
1. Rectangle = l•w
2. Square = b^2
3. Parallelogram = b•h
4. Circle = πr^2
5. Triangle = $\frac{b \bullet h}{2}$
6. Trapezoid = $(\frac{B+b}{2}) \bullet h$
7. Rhombus = $\frac{D \bullet d}{2}$
8. Regular polygon = $\frac{P_{base} \bullet a}{2}$

Ex 1: Determine the volume of this cube

$V_{cube} = A_b \bullet h$

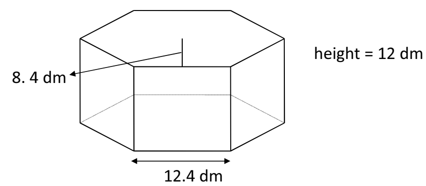
$= w^2 \bullet w$

$V_{cube} = w^3$



3 cm

Ex 2: Determine the volume of this prism

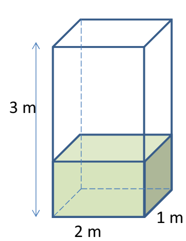


$V_{prism} = A_b \bullet h$

Ex 3: Page 195 #29

This tank is filled with 1500 L of gas. How much time will be required to fill the rest of it at a rate of 20 L/min?

$V_{tank} = A_b \bullet h$



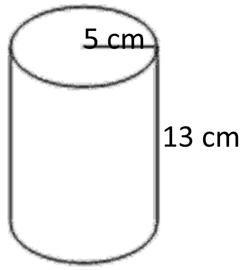
Practice:
page 193 # 17, 21, 22, 26, 28, 30

6.3-C- Volume of a Cylinder

$V_{cylinder} = \pi r^2 h$

Ex 1: Determine the volume of this cylinder

$V = \pi r^2 \bullet h$



$V_{cylinder} = \pi r^2 h$

Ex 2: Find the volume of this hot air balloon

D = 14 m
R = 7 m
H = 35 m

Diameter = 14 m
Height is 2.5 times the diameter

Ex 3: Determine the volume of material required to make a cd in **mL**

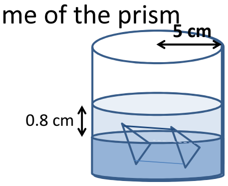
38 mm

120 mm

Thickness is 4 mm

r = 19 mm
R = 60 mm
h = 4 mm

Ex 4: page 196 # 41
A triangular base prism is submerged in a cylindrical bucket of water with a 5 cm radius. The water level in the bucket rises 0.8 cm. What is the volume of the prism submerged in the water?



Worksheet
+
page 195 # 31, 37, 39

6.3-D- Volumes of Pyramids and Cones

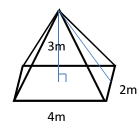
The **volume** of any pyramid or cone is 1/3 that of a prism of the same height and base.

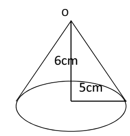
$$V = \frac{A_b \bullet h}{3}$$

$V_{pyramid} = \frac{A_b\, h}{3}$ $V_{cone} = \frac{\pi r^2 h}{3}$

$V_{pyramid} = \frac{A_b\, h}{3}$ $V_{cone} = \frac{\pi r^2 h}{3}$

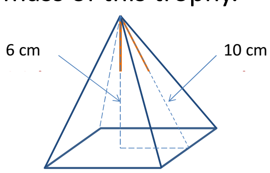
Ex 1: Find the volume





Ex 2 p. 198 # 49

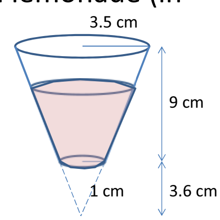
A square base pyramid trophy, has height 6 cm and its slant height is 10 cm. If it is made of aluminum and the mass of 1 dm^3 of aluminum is 2.7 Kg, calculate the mass of this trophy.



$V_{pyramid} = \frac{A_b\, h}{3}$

Ex 3: p. 199 # 58

If Eric fills the plastic cup (shown below) to $\frac{3}{4}$ its capacity with lemonade, how much lemonade (in cl) will be poured into the cup?



Practice:
page 198 # 44,47,51
page 199 # 52,56,

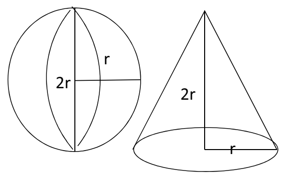
6.3-E- Volume of a Sphere

$V_{sphere} = 2\ V_{cone}$

$= 2(\frac{\pi r^2 \bullet h}{3})$

$= 2(\frac{\pi r^2 \bullet 2r}{3})$

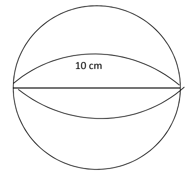
$= \frac{4\pi r^3}{3}$



$$V_{sphere} = \frac{4\pi r^3}{3}$$

$$V_{sphere} = \frac{4\pi r^3}{3}$$

Ex 1: Find the volume of the sphere with diameter 10 cm



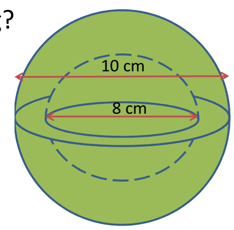
Ex 2: Find the volume of the Earth in km^3

diameter= 12 756 km

r = 6 378 km

Ex 3: p.201 # 73

The interior and exterior diameters of a metallic ball are 8 cm and 10 cm respectively. What is the ball's mass if the mass of 1 dm^3 of this metal is 3 Kg?

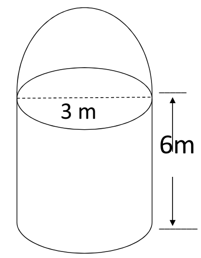


Practice:
page 200 # 59(a,b),64,68,70,72

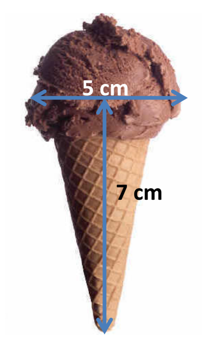
6.4 Volume of decomposable solids

1. Separate and identify the solids involved.
2. Write the formulas for all the solids involved.
3. Calculate them and add them together.

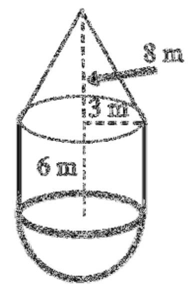
Ex 1: Find the volume of this silo in Kl:



Ex 2: Find the volume of this ice cream cone in ml:



Ex 3: Determine the volume of this space probe



SOLIDS	LATERAL AREA	TOTAL AREA	Volume
RIGHT PRISMS	$A_{LAT} = P_B \bullet h$	$A_{TOT} = P_B h + 2A_B$	$V_{prism} = A_b \bullet h$
RIGHT CYLINDERS	$A_{LAT} = 2\pi rh$	$A_{TOT} = 2\pi rh + 2\pi r^2$	$V_{cylinder} = \pi r^2 \bullet h$
RIGHT REGULAR PYRAMIDS	$A_{LAT} = \frac{P_b s}{2}$	$A_{TOT} = \frac{P_b s}{2} + A_b$	$V_{pyramid} = \frac{A_b \bullet h}{3}$
RIGHT CONES	$A_{LAT} = \pi rs$	$A_{TOT} = \pi rs + \pi r^2$	$V_{cone} = \frac{\pi r^2 \bullet h}{3}$
SPHERES	$A_{LAT} = A_{TOT} = 4\pi r^2$		$V_{sphere} = \frac{4\pi r^3}{3}$
HEMISPHERE	$A_{LAT} = A_{TOT} = 2\pi r^2$ Note: if the base is included, add πr^2		$V_{sphere} = \frac{2\pi r^3}{3}$

Practice:
page 203 # 1,2,7,8

6.5 Missing measures of a solid

Sometimes… we know the Volume or Surface Area of an object and we need to find the radius, height or side length.

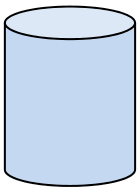
When looking for a missing measure of a solid:

1. choose and write down the applicable formula based on the information given
2. substitute in all known values
3. solve for the unknown value

Ex 1: Find the radius of the sphere

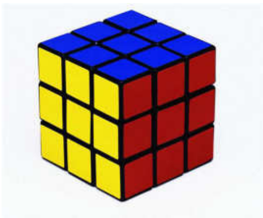
$V=2028\pi\ cm^3$

Ex 2: Find the height of the cylinder



$A_T=26.39\ m^2$
$r= 1.2\ m$

Ex 3: Find the side length of the cube

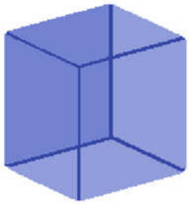


$V=185.2\ cm^3$

Ex 4: Find the radius of the cylinder

$V= 124181\ cm^3$
$h=122\ cm$

Ex 5: Find the side length of the cube



$A_T=294\ cm^2$

Practice page 205 # 1, 7, 18, 23, 27, 28, 35