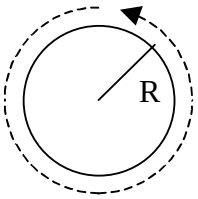
Areas and Volumes

(see Bookmarks for index)

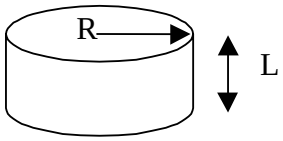
Area Formulae

Area of Circle = $\pi \times (\text{radius})^2$
$= \pi \times R^2$



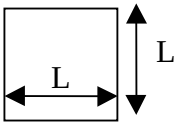
Circumference of a circle = $2\pi R$

Curved Area of a Cylinder
= Circumference × length
$= 2\pi R \times L$

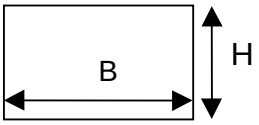


Surface Area of a Sphere (R = radius)
$= 4 \times \pi \times R^2$

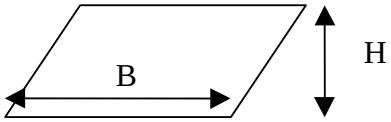
Area of Square = $(\text{length of side})^2$
$= L^2$



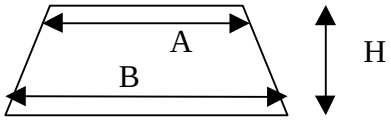
Area of Rectangle = base × height
$= B \times H$



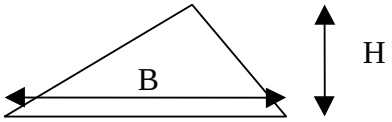
Area of Parallelogram = base × height
$= B \times H$



Area of Trapezium = average length × height
$= (1/2) \times (A + B) \times H$



Area of Triangle = half base × height
$= (1/2) \times B \times H$



Example
The main trunk of a tree is 3.6 m high and has an average radius of 0.1 m.
Estimate the area of bark on the trunk.

Surface area of the trunk as a cylinder = $2\pi R \times L = 2\pi \times 0.1 \times 3.6 = 2.26\ m^2$

Example
Water covers 71% of the Earth's surface. Estimate the total surface area of water on the Earth.
Radius of the Earth = 6400 km.

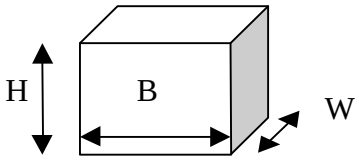
Surface area of Earth= $4 \times \pi \times R^2 = 4 \times \pi \times (6400)^2 = 5.15 \times 10^8\ km^2$
71% of this area = $0.71 \times 5.15 \times 10^8\ km^2 = 3.65 \times 10^8\ km^2$

Volume Formulae

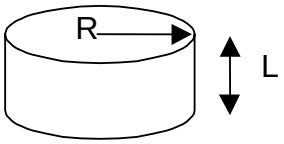
Volume of a Sphere (radius = R)

$$= \frac{4}{3} \times \pi \times R^3$$

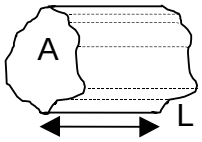
Volume of a Cuboid
= base × width ×height
$= B \times W \times H$



Volume of a Cylinder
= cross-sectional area × length
$= \pi \times R^2 \times L$



Volume of Projected Area
= cross-sectional area × length
$= A \times L$



Example
The main trunk of a tree is 3.6 m high and has an average radius of 0.1 m. Estimate the volume of the trunk

Volume of the trunk as a cylinder = $\pi \times R^2 \times L = \pi \times 0.1^2 \times 3.6 = 0.11\ m^3$

Converting Area and Volume Units

See also 2.2.4 Conversion of Units

Be careful with units of area and volume - it is easy to make simple mistakes.

For example - do not confuse 10 metres square with 10 square metres.
"10 metres square" describes a square area with sides of length 10 m.
The actual area of '10 metres square' equals $10 \times 10 = 100\ m^2$ = 100 square metres!

When converting units it is best to proceed in very small steps - do not try to do it in your head!

Conversion: metres and centimetres

$1\ m = 100\ cm$

$1\ m^2 = 100 \times 100\ cm^2 = 10000\ cm^2 = 1.0 \times 10^4\ cm^2$

$1\ m^3 = 100 \times 100 \times 100\ cm^3 = 1000000\ cm^3 = 1.0 \times 10^6\ cm^3$

Hence:

$1\ cm^2 = 1.0 \times 10^{-4}\ m^2$

$1\ cm^3 = 1.0 \times 10^{-6}\ m^3$

Conversion: kilometres and metres

$1\ km = 1000\ m = 1.0 \times 10^3\ m$

$1\ km^2 = (1.0 \times 10^3)^2\ m^2 = 1.0 \times 10^6\ m^2$

$1\ km^3 = (1.0 \times 10^3)^3\ m^3 = 1.0 \times 10^9\ m^3$

Hence:

$1\ m^2 = 1.0 \times 10^{-6}\ km^2$

$1\ m^3 = 1.0 \times 10^{-9}\ km^3$