

Surface Areas and Volumes

CBSE Class 10 Maths · Knowledge organiser

KEY DEFINITIONS

Combination of solids

A solid made by joining simple solids such as a cone on a cylinder.

Total surface area

The area of every surface you can touch on the outside of the solid.

Volume of a combination

The sum of the volumes of the parts, minus any part scooped out.

YOU SHOULD BE ABLE TO...

- Use the surface area and volume formulae of the cube, cuboid, cylinder, cone, sphere and hemisphere.
- Find the surface area and volume of solids made from two shapes, deciding which faces are exposed.
- Write complete 5-mark answers on combined solids and real objects (tents, toys, vessels) with units and conversions.
- Handle drilled holes, hollow objects and the 'largest cone in a cube' questions that decide 95+.

COMMON MISTAKES

- ✗ Adding the total surface areas of the parts and so counting the hidden joined faces.
- ✗ Using the vertical height h in $\pi r l$ instead of the slant height.
- ✗ Using the diameter as the radius, or mixing units (cm and m, mm and cm).
- ✗ For a vessel, "inner surface area" excludes the open top.

KEY FORMULAS

Cuboid l, b, h	$TSA = 2(lb + bh + hl), LSA = 2h(l + b), V = lbh$
Cube, edge a	$TSA = 6a^2, V = a^3$
Cylinder	$CSA = 2\pi rh, TSA = 2\pi r(r + h), V = \pi r^2 h$
Cone, $l = \sqrt{r^2 + h^2}$	$CSA = \pi rl, TSA = \pi r(l + r), V = \frac{1}{3}\pi r^2 h$
Sphere	$SA = 4\pi r^2, V = \frac{4}{3}\pi r^3$
Hemisphere	$CSA = 2\pi r^2, TSA = 3\pi r^2, V = \frac{2}{3}\pi r^3$

Combined solids: add only the surfaces you can see; volumes simply add (or subtract)

WORKED EXAMPLE

A toy is a cone of radius 4.2 cm on a hemisphere of the same radius. The total height is 9.8 cm. Find its total surface area ($\pi = \frac{22}{7}$).

$$\begin{aligned}\text{Cone height} &= 9.8 - 4.2 = 5.6, l = \sqrt{5.6^2 + 4.2^2} = 7. \text{ TSA} \\ &= \pi r l + 2\pi r^2 = 92.4 + 110.88 = 203.28 \text{ cm}^2.\end{aligned}$$