

Surface Area and Volume Formulas — Class 10

All six solids of NCERT Chapter 12, with the traps that cost marks. Page 1 of 2.

Surface area **covers** a solid — square units (cm^2). Volume **fills** it — cubic units (cm^3).

The six solids, complete

Solid	Curved / lateral SA	Total surface area	Volume
Cuboid (l, b, h)	$2h(l + b)$	$2(lb + bh + hl)$	$l \times b \times h$
Cube (edge a)	$4a^2$	$6a^2$	a^3
Cylinder (r, h)	$2\pi rh$	$2\pi r(r + h)$	$\pi r^2 h$
Cone (r, h, l)	πrl	$\pi r(r + l)$	$(1/3)\pi r^2 h$
Sphere (r)	$4\pi r^2$	$4\pi r^2$	$(4/3)\pi r^3$
Hemisphere (r)	$2\pi r^2$	$3\pi r^2$	$(2/3)\pi r^3$

Read the table this way: TSA = curved / lateral area + **the flat faces**. A sphere has no flat face, so its CSA and TSA are the same. A hemisphere adds one circular face πr^2 , which is why $2\pi r^2$ becomes $3\pi r^2$. An open shape — a pipe, a bucket without a lid — leaves out the face it does not have.

The three traps, and what to use instead

The question gives you	What the formula needs	Why
Vertical height h of a cone	Slant height $l = \sqrt{r^2 + h^2}$	πrl is measured along the sloping surface, not straight down
Diameter d	Radius $r = d / 2$	Every formula on this sheet is written in r
An answer in cm	cm^2 for area, cm^3 for volume	The unit is part of the answer and carries its own mark

Slant height in one line. A cone with $r = 7$ cm and $h = 24$ cm has $l = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25$ cm. Now CSA = $\pi rl = (22/7)(7)(25) = 550$ cm^2 , while volume still uses h : $(1/3)(22/7)(49)(24) = 1232$ cm^3 . **Two different heights in one question.**

Where this sits in NCERT and CBSE

Question	The verified answer
Which chapter?	NCERT Chapter 12, <i>Surface Areas and Volumes</i> — Section 12.2 surface area of a combination, Section 12.3 volume of a combination
Which exercises?	Section 12.2 $\Rightarrow$ Exercise 12.1 (9 questions); Section 12.3 $\Rightarrow$ Exercise 12.2 (8 questions). The numbers never match — 17 questions in all
How many marks?	Unit VI Mensuration, 10 of the 80 theory marks , shared with Areas Related to Circles. CBSE assigns marks by unit, never by chapter
What was removed?	Conversion of a solid from one shape to another, and the frustum of a cone — both out of the rationalised syllabus

The CBSE clause, word for word: “Surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones.” Use “**any two**” as a self-check in the exam — if a figure seems to need a third kind of solid, you have misread it.

Key takeaways

- ▶ Six solids run the whole chapter: cuboid, cube, cylinder, cone, sphere, hemisphere.
- ▶ TSA = curved / lateral area + **the flat faces**; an open shape drops the face it does not have.
- ▶ Cone: **slant height l for surface area, vertical height h for volume** — $l = \sqrt{r^2 + h^2}$.
- ▶ A hemisphere is half a sphere by volume, $(2/3)\pi r^3$, but its TSA is $3\pi r^2$, not $2\pi r^2$.
- ▶ Use $\pi = 22/7$ when r or d is a multiple of 7; otherwise 3.14, unless the question states a value.
- ▶ Every exam figure is **two** of these six joined together — add exposed surfaces, add whole volumes.

Two board questions, start to finish

Both are NCERT Chapter 12 questions. Page 2 of 2.

3 MARKS • NCERT Ex 12.1 Q3

A toy is a cone mounted on a hemisphere of the same radius 3.5 cm. The total height of the toy is 15.5 cm. Find its total surface area. (Take $\pi = 22/7$.)

Step 1 – name the two solids. A cone sitting on a hemisphere. The circular face where they meet is **hidden**, so it is not part of the surface. TSA of the toy = CSA of the cone + CSA of the hemisphere.

Step 2 – split the height. The hemisphere's own height is its radius, 3.5 cm. So the cone's vertical height $h = 15.5 - 3.5 = 12$ cm.

Step 3 – get the slant height. $l = \sqrt{(r^2 + h^2)} = \sqrt{(3.5^2 + 12^2)} = \sqrt{(12.25 + 144)} = \sqrt{156.25} = 12.5$ cm.

Step 4 – substitute. CSA of cone = $\pi rl = (22/7)(3.5)(12.5) = 137.5$ cm². CSA of hemisphere = $2\pi r^2 = 2(22/7)(12.25) = 77$ cm².

Step 5 – add, with the unit. TSA = $137.5 + 77 = 214.5$ cm².

Check: 3.5, 12, 12.5 is the 7–24–25 triple halved, so l is exact, not rounded. And the answer is an **area**, so cm² is right. Note what you did **not** add: the flat circular face $\pi r^2 = 38.5$ cm² is glued shut inside the toy.

5 MARKS • NCERT Ex 12.1 Q7

A tent is a cylinder of diameter 4 m and height 2.1 m, topped by a cone of slant height 2.8 m. Find the area of canvas used, and its cost at Rs 500 per m².

Step 1 – convert the diameter. $r = 4 / 2 = 2$ m. Miss this and every later line is wrong.

Step 2 – decide which faces exist. A tent has **no top circle and no floor of canvas** – only the cylinder's side and the cone's slope. So area = $2\pi rh + \pi rl$.

Step 3 – the cylinder. $2\pi rh = 2(22/7)(2)(2.1) = 26.4$ m².

Step 4 – the cone. $\pi rl = (22/7)(2)(2.8) = 17.6$ m². The slant height is given, so there is no Pythagoras step here – read what you are handed.

Step 5 – total and cost. Canvas = $26.4 + 17.6 = 44$ m²; cost = $44 \times 500 = \text{Rs } 22,000$.

Check: both parts share $r = 2$, so the total is $2(22/7)(2.1 + 1.4) = (44/7)(3.5) = 44$ exactly – a whole number, which is the examiner's hint that you took the right faces.

WHERE THE MARKS ACTUALLY GO

The formula line	No formula sheet is supplied. Writing πrl before you substitute is a mark of its own, even if the arithmetic then slips.
The faces you leave out	Say in words which face is hidden or missing. A TSA that quietly includes a glued face loses the reasoning mark.
The substitution line	Show the numbers going in. An answer with no substitution earns the answer mark only.
The unit	cm ² or cm ³ , never the wrong one and never blank. This is the cheapest mark on the paper.

NOW TRY THIS ONE • NCERT Ex 12.1 Q9

A wooden article is a cylinder of radius 3.5 cm and height 10 cm, with a **hemisphere scooped out of each end**. Find the total surface area of the article. ($\pi = 22/7$.)

Think first, then check: scooping out does not remove surface – it swaps each flat end for a curved bowl. So TSA = cylinder's CSA + two hemisphere CSAs = $220 + 154 = 374$ cm².

Practise these on examfront

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