

Surface Areas and Volumes

Every question wants one of three things: **curved surface area**, **total surface area** or **volume**. Decide which, then pick the solid.

The six solids, all three quantities

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

Slant height is not vertical height. For a cone, $l^2 = r^2 + h^2$ — so $r = 7, h = 24$ gives $l = 25$, because $49 + 576 = 625$. Using h in place of l is the single most common formula slip in this chapter.

Joining solids: volumes add, surface areas do not

Volume. Nothing disappears when two solids are stuck together, so the volumes simply add. A cone on a hemisphere holds $(1/3)\pi r^2 h + (2/3)\pi r^3$.

Surface area. The flat faces at the join are sealed inside and are no longer painted, so they are **not** counted. A cone on a hemisphere of the same radius has area $\pi rl + 2\pi r^2$ — the shared circle πr^2 appears nowhere.

Cavities and depressions go the other way. Scoop a hemisphere out of a cube and you **remove** the flat circle πr^2 but **expose** the curved bowl $2\pi r^2$, so the surface area **rises**: $6a^2 - \pi r^2 + 2\pi r^2 = 6a^2 + \pi r^2$. The volume, of course, falls.

What NCERT and CBSE actually set

Question	Answer
Where is it in NCERT?	Chapter 12. Section 12.2 (surface area of a combination) → Exercise 12.1, 9 questions ; Section 12.3 (volume of a combination) → Exercise 12.2, 8 questions . The section and exercise numbers never match — a standing trap.
What is it worth?	Unit VI Mensuration, 10 of the 80 theory marks , shared with Areas Related to Circles. CBSE sets marks by unit, never by chapter ; chapter-wise percentage tables online are unofficial.
What was removed?	Conversion of a solid from one shape to another (melt and recast) and the frustum of a cone . Old question banks still set them; they are no longer examinable.
How is it asked?	A 3-mark Section C or 5-mark Section D question, sometimes a 4-mark case study. No formula sheet is supplied, so the formula line is itself a mark.

The CBSE syllabus in one line: “Surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones.” Read **any two as two kinds**, not two pieces — a capsule is three pieces but only two kinds.

Key takeaways

1. Name the quantity first — curved SA, total SA or volume. Half the lost marks in this chapter are answering the wrong question well.
2. Units are the check: area lands in cm^2 or m^2 , volume in cm^3 or m^3 . A cm^3 answer to an area question is wrong before you read it.
3. Measurements are quoted as **diameters** far more often than as radii. Halve it before it enters a formula.
4. When solids are joined, volumes add exactly; surface areas do not, because the join is hidden.
5. Scooping a cavity **increases** surface area ($-\pi r^2, +2\pi r^2$) and decreases volume.
6. For a cone, always derive l from $l^2 = r^2 + h^2$ unless the slant height is given outright.

Worked from the NCERT exercises

One surface-area question, one volume question, and one to try yourself

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NCERT Ex 12.1 Q2 • surface area • 3 marks

A vessel is a hollow hemisphere with a hollow cylinder mounted on it. The hemisphere has diameter 14 cm and the total height of the vessel is 13 cm. Find the inner surface area. ($\pi = 22/7$)

Step 1 – radius. Diameter 14 cm, so $r = 7$ cm for both the hemisphere and the cylinder.

Step 2 – the cylinder's height is not 13. Total height 13 cm includes the hemisphere's own radius: $h = 13 - 7 = 6$ cm.

Step 3 – name the exposed surfaces. Inner surface = curved surface of the cylinder + curved surface of the hemisphere. The circle where they meet is inside the vessel wall, not a surface, and the vessel is open at the top.

Step 4 – substitute. $2\pi rh + 2\pi r^2 = 2(22/7)(7)(6) + 2(22/7)(7)(7) = 264 + 308$.

Answer 572 cm². Check: both terms are $2\pi r \times (\text{something})$, so the total is $2\pi r(h + r) = 2(22/7)(7)(13) = 44 \times 13 = 572$. Two routes, one number.

NCERT Ex 12.2 Q1 • volume • 2 marks

A solid is a cone standing on a hemisphere, both of radius 1 cm, and the height of the cone equals its radius. Find the volume of the solid in terms of π .

Step 1 – volumes add. No space is lost at the join, so $V = \text{cone} + \text{hemisphere}$ with no subtraction anywhere.

Step 2 – substitute $r = 1$, $h = 1$. $(1/3)\pi r^2 h + (2/3)\pi r^3 = (1/3)\pi + (2/3)\pi$.

Answer π cm³ (about 3.14 cm³). Check: the thirds sum to one whole, which is why this question is set – a clean answer is the marker's signal you added rather than subtracted. Note the question says *in terms of π* : leave it as π , do not decimalise.

WHERE THE MARKS ACTUALLY GO

What you write	What it earns
The sentence naming which surfaces are exposed	The examiner marks the decision , not only the arithmetic – this line scores even if a later digit slips.
The formula, written before any number	A method mark. No formula sheet is supplied in the exam.
The conversion of diameter to radius	Stops the commonest single error in the chapter.
The unit on the final line	cm ² or cm ³ – an unlabelled number is an incomplete answer.

NOW TRY THIS ONE • NCERT Ex 12.1 Q1

Two cubes, each of volume 64 cm³, are joined end to end. Find the surface area of the resulting cuboid.

Start from the volume: $a^3 = 64$ gives the edge. Joining them end to end makes a cuboid, and two square faces vanish inside the join.

Answer: 160 cm².

READING THE WORDS INTO THE SOLID

When the question says	What it is telling you
"hollow", "inner surface area"	Count the inside faces only, and an open top contributes no area at all.
"surmounted by", "mounted on"	A join – the shared circle is hidden, so leave it out of the surface area.
"scooped out", "depression", "cavity"	Surface area rises and volume falls. Subtract the flat face, add the curved one.
"in terms of π "	Leave π in the answer. Substituting 22/7 here can cost the accuracy mark.

Turn this chapter into marks on examfront

- **Chapter 1 is free** – start practising today, no payment needed.
- **Mistake identification** – see whether you lost the mark on the formula, the radius or the units.
- **Anytime tests** – practise any chapter, at any time, at your own level.
- **Weekly tests** – keep earlier chapters warm while you move forward.
- **Mock tests before the exam** – full papers under real timing, so board day is familiar.

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