Class 10 Maths Chapter 12: Surface Areas and Volumes - Notes, Important Questions and MCQs (2026-27)

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These Surface Areas and Volumes Class 10 notes cover NCERT Class 10 Maths Chapter 12 for 2026-27: formulas for all basic solids and how to find the surface area and volume of combinations of solids – with a formula table, solved problems, 10 MCQs and a free PDF.

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Chapter Overview

Many everyday objects are made by joining basic solids: a capsule (cylinder + two hemispheres), a tent (cylinder + cone), a toy (cone on a hemisphere) or a pen stand (cuboid with conical holes).

To find the surface area of a combined solid, add only the surfaces that are visible from outside. To find the volume, add (or subtract) the volumes of the parts. (Conversion of solids and the frustum of a cone are not in the 2026-27 syllabus.)

Important Topics and Concepts

Formulas for Basic Solids

- Cuboid (l, b, h): TSA = 2(lb + bh + hl); V = lbh.

- Cube (a): TSA = $6a^2$; V = a^3.
- Cylinder (r, h): CSA = $2\pi rh$; TSA = $2\pi r(r + h)$; V = $\pi r^2 h$.
- Cone (r, h, l): l = $\sqrt{(r^2 + h^2)}$; CSA = πrl; TSA = $\pi r(l + r)$; V = $\frac{1}{3}\pi r^2 h$.
- Sphere (r): SA = $4\pi r^2$; V = $(4/3)\pi r^3$.
- Hemisphere (r): CSA = $2\pi r^2$; TSA = $3\pi r^2$; V = $(2/3)\pi r^3$.

Surface Area of Combined Solids

- Add the curved/visible surfaces of each part.
- Do not include the surfaces where two solids are joined.
- When a hemisphere sits on a cube face: TSA = cube TSA − πr^2 + $2\pi r^2$.
- Toy (cone on hemisphere): TSA = $2\pi r^2$ + πrl.
- Tent (cone on cylinder): canvas = CSA of cylinder + CSA of cone.

Volume of Combined Solids

- Add the volumes of all parts that make the solid.
- Subtract the volume of any part removed (e.g. holes in a pen stand).
- Capsule: V = $\pi r^2 h$ + $(4/3)\pi r^3$ (cylinder + two hemispheres).
- Express answers in proper units (cm^3, m^3) and convert litres if asked (1000 cm^3 = 1 litre).

Solved Examples

Board-pattern problems with full working.

- A toy is a cone of radius 3.5 cm on a hemisphere of the same radius. Total height 15.5 cm. Find its TSA (π = 22/7). Cone height = 12, slant = 12.5. TSA = $2\pi r^2$ + πrl = $\pi r(2r + l)$ = $(22/7)(3.5)(19.5)$ = 214.5 cm^2.
- A cubical block of side 7 cm is surmounted by a hemisphere of the greatest possible diameter. Find the surface area. r = 3.5; SA = $6a^2$ − πr^2 + $2\pi r^2$ = 294 + 38.5 = 332.5 cm^2.
- Two cubes of volume 64 cm^3 each are joined end to end. Find the surface area of the cuboid. Side 4 → cuboid 8 × 4 × 4. SA = 2(32 + 16 + 32) = 160 cm^2.
- A tent is a cylinder of height 2.1 m and diameter 4 m with a conical top of slant height 2.8 m. Find the canvas area and cost at ₹500/m^2. Canvas = $2\pi(2)(2.1)$ + $\pi(2)(2.8)$ = 14π = 44 m^2. Cost = ₹22,000.

What to Add in Combined Solids

The rule examiners check.

Combined solid	Surface area	Volume
Cone on hemisphere (toy)	CSA cone + CSA hemisphere	$\frac{1}{3}\pi r^2 h$ + $(2/3)\pi r^3$
Cylinder with two hemispheres (capsule)	$2\pi rh$ + $4\pi r^2$	$\pi r^2 h$ + $(4/3)\pi r^3$
Cone on cylinder (tent)	CSA cylinder + CSA cone	$\pi r^2 H$ + $\frac{1}{3}\pi r^2 h$
Hemisphere on cube	$6a^2$ + πr^2	a^3 + $(2/3)\pi r^3$
Hollow hemisphere + cylinder (vessel, inner)	$2\pi r^2$ + $2\pi rh$	$(2/3)\pi r^3$ + $\pi r^2 h$

Key Formulas at a Glance

Solid	CSA / LSA	TSA	Volume
Cuboid	$2h(l + b)$	$2(lb + bh + hl)$	lbh
Cube	$4a^2$	$6a^2$	a^3
Cylinder	$2\pi rh$	$2\pi r(r + h)$	πr^2h
Cone	πrl	$\pi r(l + r)$	$\frac{1}{3}\pi r^2h$
Sphere	$4\pi r^2$	$4\pi r^2$	$(4/3)\pi r^3$
Hemisphere	$2\pi r^2$	$3\pi r^2$	$(2/3)\pi r^3$

Important Formulas and Definitions

Formula / Term	Meaning / Use
CSA	Curved surface area – area of the curved part only
TSA	Total surface area – all outer surfaces
Slant height (l)	$\sqrt{(r^2 + h^2)}$ for a cone
Volume	Space occupied by a solid
Combined solid	Solid formed by joining two or more basic solids
Hemisphere	Half of a sphere

Short Answer Questions

Q1. Find the volume of a cone of radius 7 cm and height 12 cm ($\pi = 22/7$).

$\frac{1}{3} \times (22/7) \times 49 \times 12 = 616$ cm³.

Q2. Find the curved surface area of a hemisphere of radius 7 cm.

$2\pi r^2 = 2 \times (22/7) \times 49 = 308$ cm².

Q3. A solid is a hemisphere of radius 1 cm with a cone of the same radius and height 1 cm on it. Find its volume in terms of π.

$(2/3)\pi + (1/3)\pi = \pi$ cm³.

Q4. A vessel is a hollow hemisphere mounted by a hollow cylinder. Diameter 14 cm, total height 13 cm. Find the inner surface area.

Cylinder height = $13 - 7 = 6$. Inner SA = $2\pi r^2 + 2\pi rh = 2\pi \times 7 \times 13 = 572$ cm².

Q5. Find the TSA of a cylinder of radius 7 cm and height 10 cm.

$2\pi r(r + h) = 2 \times (22/7) \times 7 \times 17 = 748$ cm².

Q6. How many litres does a cylindrical tank of radius 0.7 m and height 2 m hold?

$\pi r^2h = (22/7) \times 0.49 \times 2 = 3.08$ m³ = 3080 litres.

Q7. Find the slant height of a cone with r = 6 cm and h = 8 cm.

$l = \sqrt{(36 + 64)} = 10$ cm.

The base of the cone is joined to the hemisphere and is not on the outside, so it is not part of the surface area.

Long Answer Questions

Q1. A gulab jamun contains sugar syrup up to about 30% of its volume. Find how much syrup is in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends, of length 5 cm and diameter 2.8 cm.

r = 1.4 cm; cylinder length = 5 − 2.8 = 2.2 cm.

Volume of one = $\pi r^2 h + (4/3)\pi r^3 = (22/7)(1.96)(2.2) + (4/3)(22/7)(2.744) \approx 13.55 + 11.50 = 25.05$ cm³.

Volume of 45 = 45 × 25.05 ≈ 1127.4 cm³.

Syrup = 30% of 1127.4 ≈ 338 cm³.

About 338 cm³ of syrup.

Q2. A wooden article is made by scooping out a hemisphere from each end of a solid cylinder of height 10 cm and radius 3.5 cm. Find its total surface area.

Surface = CSA of cylinder + 2 × CSA of hemisphere.

CSA of cylinder = $2\pi rh = 2 \times (22/7) \times 3.5 \times 10 = 220$ cm².

CSA of two hemispheres = $2 \times 2\pi r^2 = 4 \times (22/7) \times 12.25 = 154$ cm².

TSA = 220 + 154 = 374 cm².

Total surface area = 374 cm².

Q3. A medicine capsule is a cylinder with two hemispheres stuck to its ends. The capsule is 14 mm long and 5 mm wide. Find its surface area.

r = 2.5 mm; cylinder length = 14 − 5 = 9 mm.

Surface area = $2\pi rh + 4\pi r^2$.

= $2 \times (22/7) \times 2.5 \times 9 + 4 \times (22/7) \times 6.25$.

= 141.43 + 78.57 = 220 mm².

Surface area = 220 mm².

MCQs with Answers

1. Volume of a hemisphere of radius r is(a) $(4/3)\pi r^3$ (b) $(2/3)\pi r^3$ (c) $2\pi r^2$ (d) $3\pi r^2$Answer: (b) $(2/3)\pi r^3$

2. TSA of a cube of side 5 cm is(a) 125 cm² (b) 150 cm² (c) 100 cm² (d) 25 cm²Answer: (b) 150 cm²

3. CSA of a cone is(a) πrl (b) $\pi r^2 h$ (c) $2\pi rh$ (d) $\pi r(l + r)$Answer: (a) πrl

4. A capsule is a combination of(a) cone and cylinder (b) cylinder and two hemispheres (c) sphere and cone (d) cube and coneAnswer: (b) cylinder and two hemispheres

5. Two cubes of side 3 cm joined end to end give a cuboid of surface area(a) 90 cm² (b) 108

6. Slant height of a cone with r = 5, h = 12 is(a) 13 (b) 17 (c) 7 (d) √119Answer: (a) 13

7. Volume of a sphere of radius 3 cm in terms of π is(a) 36π (b) 27π (c) 12π (d) 9πAnswer: (a) 36π

8. TSA of a hemisphere is(a) $2\pi r^2$ (b) $3\pi r^2$ (c) $4\pi r^2$ (d) πr^2Answer: (b) $3\pi r^2$

9. 1 m^3 =(a) 100 litres (b) 1000 litres (c) 10 litres (d) 10000 litresAnswer: (b) 1000 litres

10. Which topic is NOT in the 2026-27 syllabus of this chapter?(a) Combination of solids (b) Volume of a cone (c) Frustum of a cone (d) Surface area of a sphereAnswer: (c) Frustum of a cone

Quick Revision Points

- Know CSA, TSA and volume of all six solids.
- Cone slant height $l = \sqrt{(r^2 + h^2)}$.
- Combined SA: add visible surfaces only.
- Combined volume: add parts; subtract scooped parts.
- 1000 cm^3 = 1 litre; 1 m^3 = 1000 litres.
- Use the given π value and keep units consistent.

Chapter Summary

Surface Areas and Volumes applies the formulas for cuboids, cubes, cylinders, cones, spheres and hemispheres to objects made by combining them. For surface area, add only the exposed surfaces; for volume, add the volumes of all parts.

Typical problems include toys, tents, capsules, vessels, blocks topped by hemispheres and objects with scooped-out parts.

Exam Tips and PYQ Pattern

- A 4–5 mark combined-solid question is very common – draw the figure and list the surfaces.
- Write the formula for each part before substituting.
- Watch the units (mm, cm, m) and convert litres where needed.
- Use π = 22/7 when the radius is a multiple of 7 or 3.5.
- Frustum and conversion of solids are not in the 2026-27 syllabus.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the NCERT Class 10 Mathematics textbook and the rationalised CBSE syllabus for 2026-27.

Can I download these notes as a PDF?

Yes. Use the free PDF link at the top of this page – no signup needed.

How do you find the surface area of a combination of solids?

Is the frustum of a cone in the 2026-27 syllabus?

No. The rationalised syllabus covers surface areas and volumes of combinations of solids only.

Conclusion

Surface Areas and Volumes is formula-heavy but straightforward. Learn the formula table, practise the solved combined-solid problems here, and save the free PDF for revision.

More Notes: Class 10 Maths Chapter 11: Areas Related to Circles notes | Class 10 Maths Chapter 13: Statistics notes | All Class 10 Maths notes

Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE mathematics educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 10 Maths textbook, Mathematics (Reprint 2026-27), and the CBSE syllabus for the 2026-27 session. Last checked on 16 November 2026.