CLASS 10 MATHS NCERT SOLUTIONS

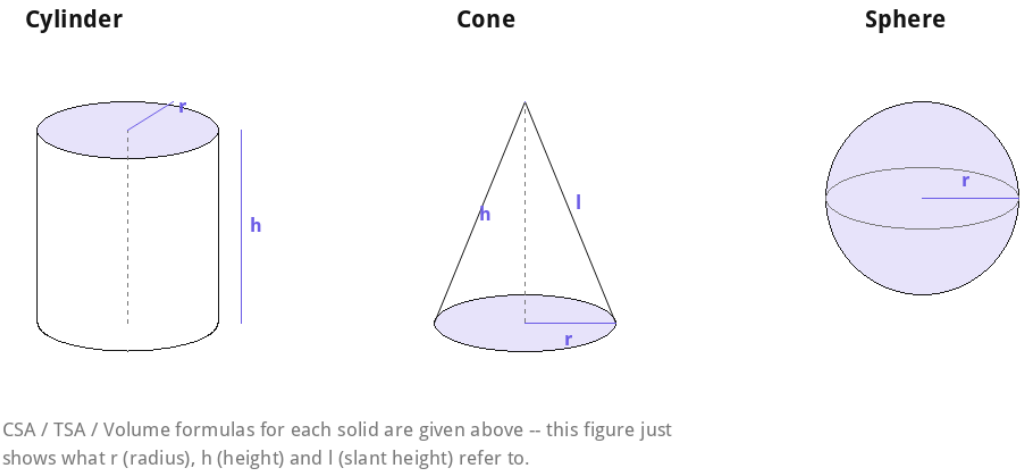
Class 10 Maths Chapter 12 Surface Areas and Volumes NCERT Solutions (2026-27)

Chapter 12, Surface Areas and Volumes, is one of the highest-weightage chapters in the Class 10 Maths board exam. It combines mensuration formulas from earlier classes (cubes, cuboids, cylinders, cones, spheres, hemispheres) into problems on combinations of solids — a favourite source of 3-5 mark board questions. ...

Contents

Chapter 12, **Surface Areas and Volumes**, is one of the highest-weightage chapters in the Class 10 Maths board exam. It combines mensuration formulas from earlier classes (cubes, cuboids, cylinders, cones, spheres, hemispheres) into problems on *combinations of solids* — a favourite source of 3-5 mark board questions. Getting comfortable with visualising which surfaces are “hidden” when two solids are joined is the single most important skill this chapter teaches, and it carries directly into similar problems in competitive exams like NTSE and Olympiads.

As per the current 2026-27 rationalised NCERT syllabus, this chapter has **two exercises** — 12.1 (Surface Area of a Combination of Solids) and 12.2 (Volume of a Combination of Solids) — 17 questions in total. Some older solution sites online still show a third exercise, 12.3, on converting one solid into another; that exercise was removed in the 2023 rationalisation, so ignore any “12.3” content you find elsewhere — it does not exist in the current book.

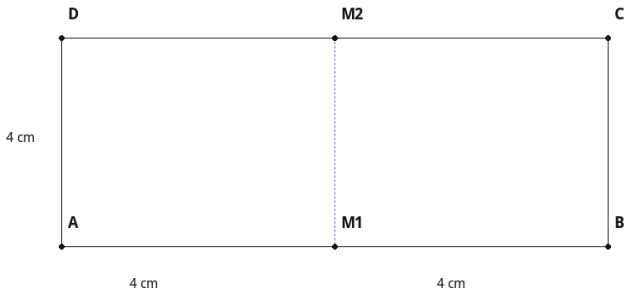


CSA / TSA / Volume formulas for each solid are given above -- this figure just shows what r (radius), h (height) and l (slant height) refer to.

Reference figure — solids covered in this chapter (cylinder, cone, sphere)

Exercise 12.1 — Surface Areas of Combination of Solids (use π = 22/7 unless stated)

Q1. Two cubes, each of volume 64 cm³, are joined end to end. Find the surface area of the resulting cuboid.



Two 4 cm cubes joined -> cuboid 8×4×4 cm, TSA=160 cm².

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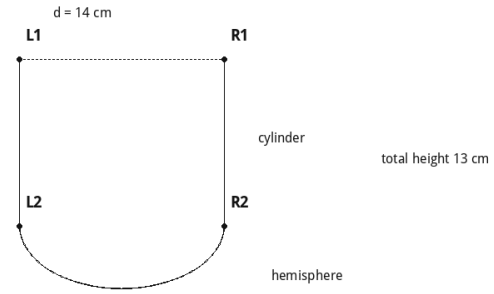
Solution: Side of each cube, $a^3 = 64 \implies a = 4$ cm. Joining two cubes end to end gives a cuboid of dimensions 8 cm × 4 cm × 4 cm.
Surface area = $2(lb + bh + hl) = 2(8\times4 + 4\times4 + 4\times8) = 2(32+16+32) = 2\times80 =$ **160 cm².**

Q2. A vessel is a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 13 cm. Find the inner surface area of the vessel.

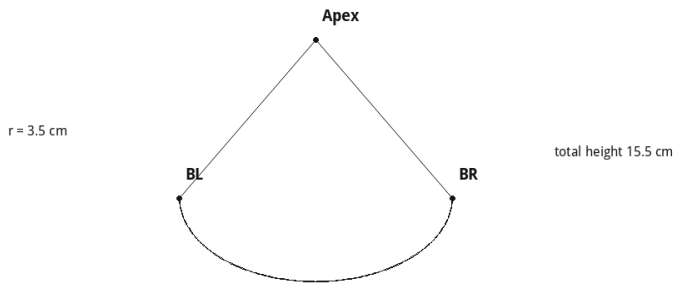


Hollow hemisphere (d=14 cm) mounted by hollow cylinder, total height 13 cm.

Hollow hemisphere (d=14 cm) mounted by hollow cylinder, total height 13 cm.

Solution: r = 7 cm. Height of cylindrical part = 13 − 7 = 6 cm.
Inner surface area = $2\pi rh + 2\pi r^2 = 2\pi r(h + r) = 2\times(22/7)\times7\times(6+7) = 2\times22\times13 =$ **572 cm².**

Q3. A toy is a cone of radius 3.5 cm mounted on a hemisphere of the same radius. Total height of the toy is 15.5 cm. Find its total surface area.

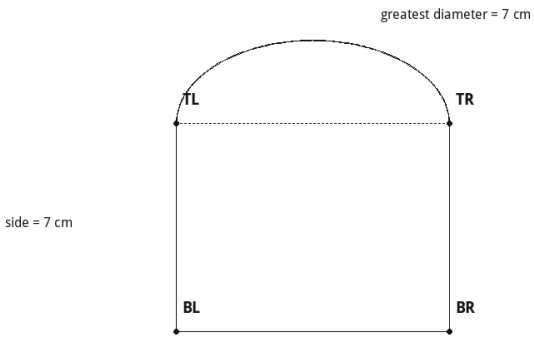


Cone (r=3.5 cm) mounted on hemisphere of same radius; total height 15.5 cm.

Cone (r=3.5 cm) mounted on hemisphere of same radius; total height 15.5 cm.

Solution: r = 3.5 cm, height of cone h = 15.5 − 3.5 = 12 cm. Slant height l = $\sqrt{(r^2+h^2)}$ = $\sqrt{(12.25+144)}$ = $\sqrt{156.25}$ = 12.5 cm.
TSA = $\pi rl + 2\pi r^2 = \pi r(l + 2r)$ = $(22/7)\times 3.5\times(12.5+7)$ = 11×19.5 = **214.5 cm².**

Q4. A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have, and what is the surface area of the solid?

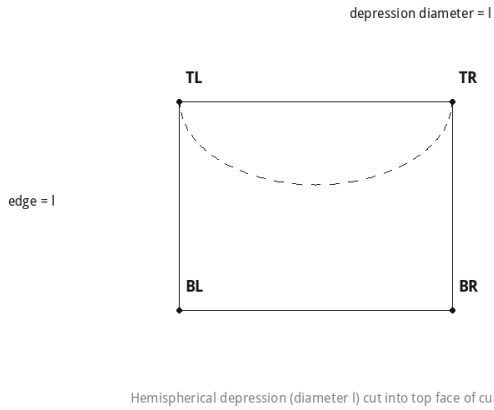


Hemisphere (greatest diameter 7 cm) surmounted on a 7 cm cube.

Hemisphere (greatest diameter 7 cm) surmounted on a 7 cm cube.

Solution: Greatest possible diameter = side of cube = 7 cm $\Longrightarrow$ r = 3.5 cm.
Surface area = (surface area of cube) − (base circle of hemisphere) + (curved surface of hemisphere) = $6\times 7^2 + \pi r^2$ (since $-\pi r^2+2\pi r^2 = \pi r^2$) = 294 + $(22/7\times 3.5\times 3.5)$ = 294 + 38.5 = **332.5 cm².**

Q5. A hemispherical depression is cut from one face of a cubical wooden block of edge l, such that the diameter of the hemisphere equals l. Find the surface area of the remaining solid.

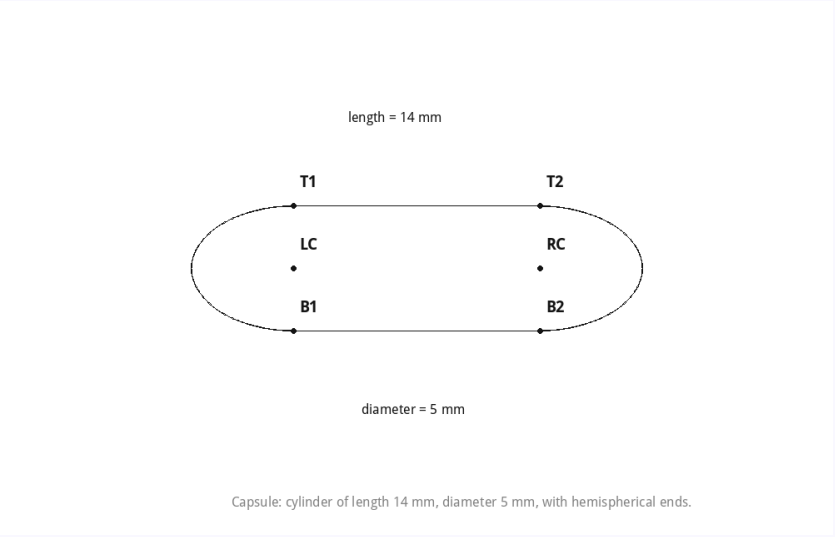


Hemispherical depression (diameter l) cut into top face of cube of edge l.

Hemispherical depression (diameter l) cut into top face of cube of edge l.

Solution: r = l/2. Surface area = $6l^2 - \pi r^2 + 2\pi r^2 = 6l^2 + \pi r^2 = 6l^2 + \pi(l/2)^2 =$ **$(6 + \pi/4)l^2$, i.e. $[(24+\pi)/4]l^2$.**

Q6. A medicine capsule is a cylinder with two hemispheres stuck to its ends. Total length 14 mm, diameter 5 mm. Find its surface area.

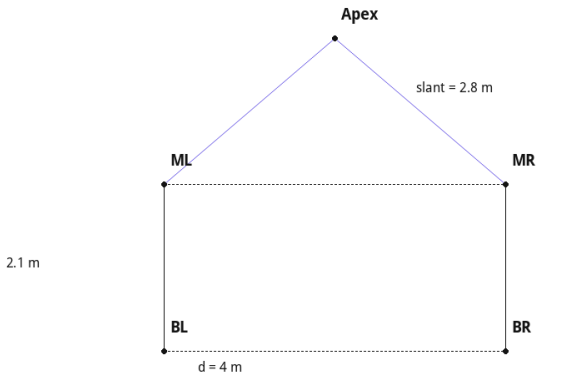


Capsule: cylinder of length 14 mm, diameter 5 mm, with hemispherical ends.

Capsule: cylinder of length 14 mm, diameter 5 mm, with hemispherical ends.

Solution: r = 2.5 mm. Cylinder length = $14 - 2\times2.5 = 9$ mm.
Surface area = $2\pi rh + 2(2\pi r^2) = 2\pi r(h+2r) = 2\times(22/7)\times2.5\times(9+5) = 2\times(22/7)\times2.5\times14 =$ **220 mm².**

Q7. A tent is a cylinder surmounted by a cone. Cylinder height 2.1 m, diameter 4 m, slant height of the cone 2.8 m. Find the area of canvas used and its cost at ₹500/m².

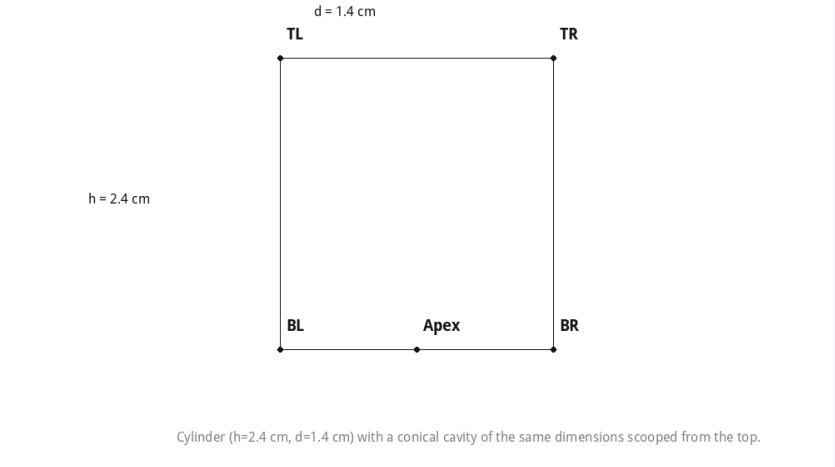


Tent: cylinder (h=2.1 m, d=4 m) surmounted by cone (slant=2.8 m).

Tent: cylinder (h=2.1 m, d=4 m) surmounted by cone (slant=2.8 m).

Solution: r = 2 m. Canvas area = 2πrh + πrl = πr(2h+l) = (22/7)×2×(4.2+2.8) = (22/7)×2×7 = **44 m².** Cost = 44 × 500 = **₹22,000.**

Q8. From a solid cylinder of height 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and diameter is hollowed out. Find the total surface area of the remaining solid (nearest cm²).

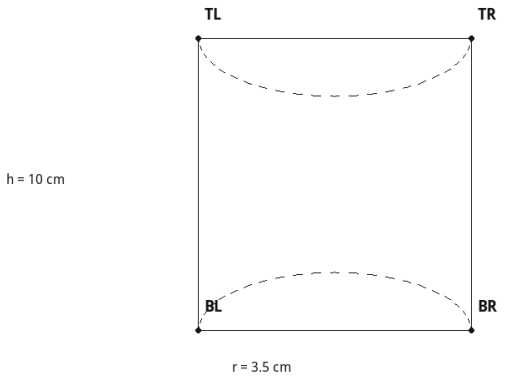


Cylinder (h=2.4 cm, d=1.4 cm) with a conical cavity of the same dimensions scooped from the top.

Cylinder (h=2.4 cm, d=1.4 cm) with a conical cavity of the same dimensions scooped from the top.

Solution: r = 0.7 cm. Slant height of cavity l = √(r²+h²) = √(0.49+5.76) = √6.25 = 2.5 cm. TSA = CSA of cylinder + base circle + CSA of cone cavity = 2πrh + πr² + πrl = 10.56 + 1.54 + 5.5 = 17.6 ≈ **18 cm².**

Q9. A wooden article is made by scooping out a hemisphere from each end of a solid cylinder of height 10 cm and base radius 3.5 cm. Find its total surface area.



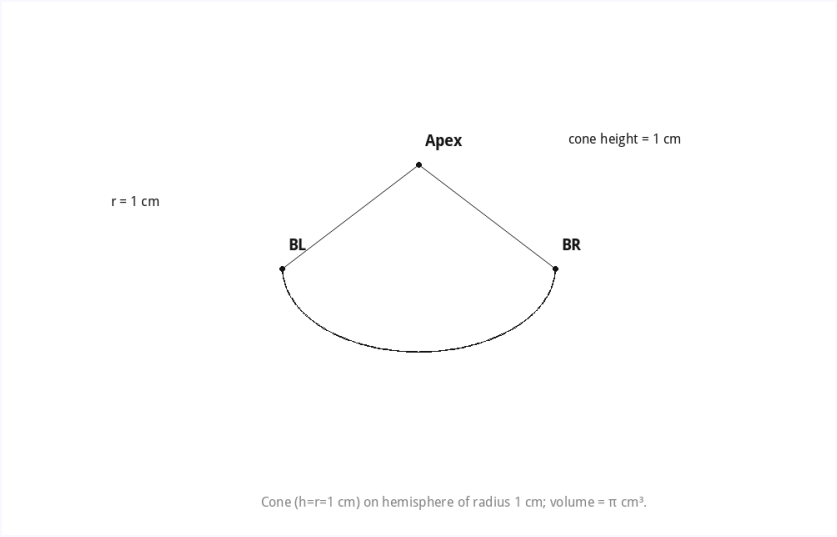
Cylinder (h=10 cm, r=3.5 cm) with a hemisphere scooped from each end.

Cylinder (h=10 cm, r=3.5 cm) with a hemisphere scooped from each end.

Solution: TSA = CSA of cylinder + 2×(CSA of hemisphere) = $2\pi rh + 2(2\pi r^2) = 2\pi r(h+2r) = 2\times(22/7)\times3.5\times(10+7) = 22\times17 =$ **374 cm².**

Exercise 12.2 — Volumes of Combination of Solids

Q1. A solid cone stands on a hemisphere, both of radius 1 cm, and the cone's height equals its radius. Find the volume in terms of π.

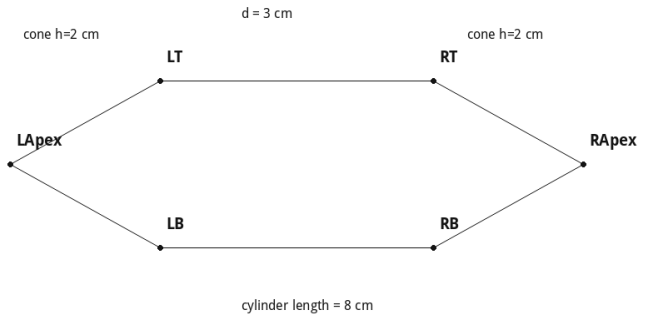


Cone (h=r=1 cm) on hemisphere of radius 1 cm; volume = π cm³.

Cone (h=r=1 cm) on hemisphere of radius 1 cm; volume = π cm³.

Solution: Volume = $(1/3)\pi r^2h + (2/3)\pi r^3 = (1/3)\pi(1)(1) + (2/3)\pi(1) = \pi/3 + 2\pi/3 =$ **π cm³.**

Q2. Rachel's model: a cylinder with two cones attached at its ends, diameter 3 cm, total length 12 cm, each cone of height 2 cm. Find the volume of air inside.

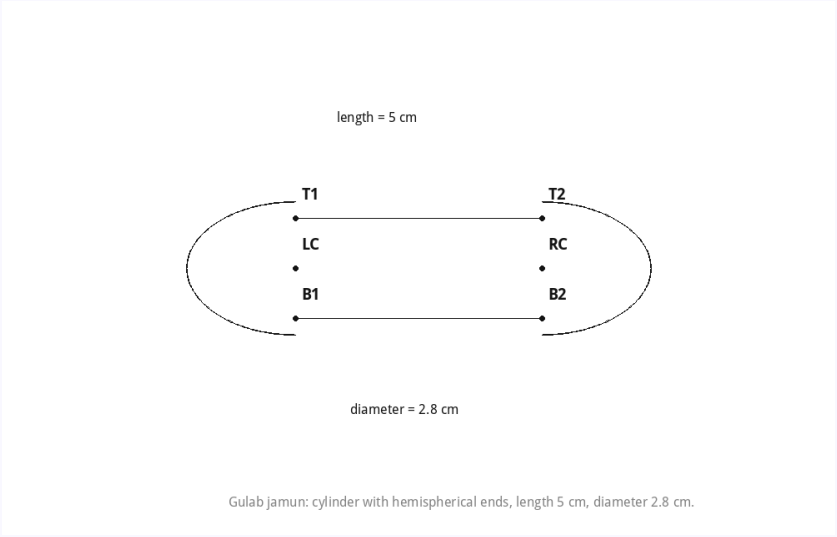


Rachel's rocket model: cylinder (d=3 cm, length 8 cm) with a 2 cm-tall cone at each end; total length 12 cm.

Rachel's rocket model: cylinder (d=3 cm, length 8 cm) with a 2 cm-tall cone at each end; total length 12 cm.

Solution: r = 1.5 cm. Cylinder height = 12 − 2×2 = 8 cm. Volume = $\pi r^2[h + (2/3)(2)] = \pi(2.25)(8 + 4/3) = \pi \times 2.25 \times (28/3) = 21\pi = 21 \times 22/7 =$ **66 cm³.**

Q3. A gulab jamun (cylinder with two hemispherical ends), length 5 cm, diameter 2.8 cm, holds sugar syrup up to 30% of its volume. Find the approximate syrup in 45 gulab jamuns.

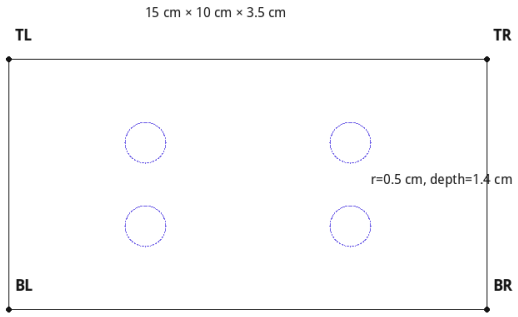


Gulab jamun: cylinder with hemispherical ends, length 5 cm, diameter 2.8 cm.

Gulab jamun: cylinder with hemispherical ends, length 5 cm, diameter 2.8 cm.

Solution: r = 1.4 cm, cylinder height = 5 − 2.8 = 2.2 cm. Volume of one = $\pi r^2 h + (4/3)\pi r^3 \approx 25.05$ cm³. For 45 pieces: 45×25.05 ≈ 1127.25 cm³. Syrup (30%) ≈ 0.3×1127.25 ≈ **338 cm³.**

Q4. A wooden pen stand, a cuboid 15 cm × 10 cm × 3.5 cm, has four conical depressions of radius 0.5 cm and depth 1.4 cm each. Find the volume of wood.

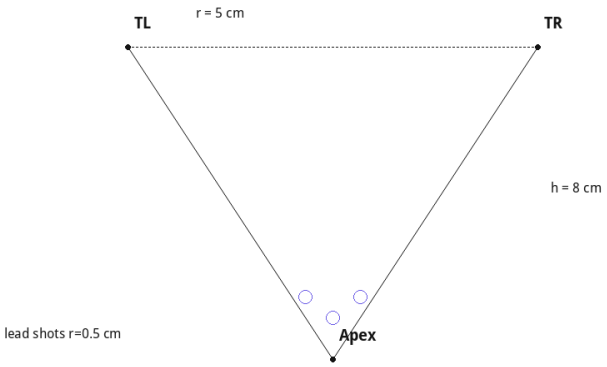


Cuboid pen stand (top view) with 4 conical depressions, r=0.5 cm, depth 1.4 cm.

Cuboid pen stand (top view) with 4 conical depressions, r=0.5 cm, depth 1.4 cm.

Solution: Cuboid volume = 15×10×3.5 = 525 cm³. One cone = (1/3)π(0.25)(1.4) ≈ 0.367 cm³; four cones ≈ 1.47 cm³. Wood volume = 525 − 1.47 ≈ **523.53 cm³.**

Q5. An inverted conical vessel, height 8 cm, top radius 5 cm, is filled to the brim. Lead shots of radius 0.5 cm are dropped in, and one-fourth of the water flows out. Find the number of lead shots.

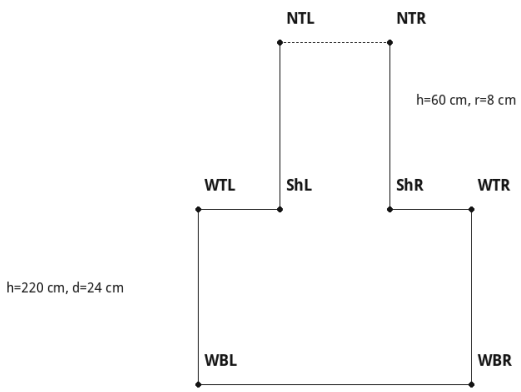


Inverted cone (r=5 cm, h=8 cm) filled to brim; lead shots (r=0.5 cm) dropped in, 1/4 water overflows.

Inverted cone (r=5 cm, h=8 cm) filled to brim; lead shots (r=0.5 cm) dropped in, 1/4 water overflows.

Solution: Cone volume = (1/3)π(25)(8) = 200π/3. Water displaced = (1/4)×200π/3 = 50π/3. One shot's volume = (4/3)π(0.5)³ = π/6. Number of shots = (50π/3)/(π/6) = **100.**

Q6. An iron pole is a cylinder of height 220 cm, base diameter 24 cm, surmounted by another cylinder of height 60 cm, radius 8 cm. Find its mass (1 cm³ iron ≈ 8 g, use π = 3.14).

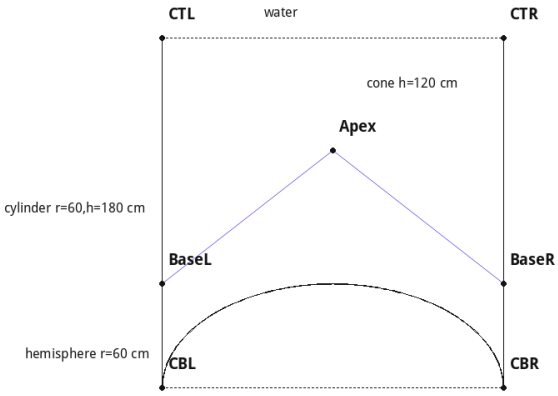


Iron pole: cylinder (h=220 cm, d=24 cm) surmounted by a narrower cylinder (h=60 cm, r=8 cm).

Iron pole: cylinder (h=220 cm, d=24 cm) surmounted by a narrower cylinder (h=60 cm, r=8 cm).

Solution: Volume = π(144×220 + 64×60) = π×35520 ≈ 3.14×35520 = 111,532.8 cm³. Mass = 111,532.8×8 g = 892,262.4 g ≈ **892.26 kg.**

Q7. A cone (h=120 cm, r=60 cm) on a hemisphere (r=60 cm) stands upright, touching the bottom, inside a cylinder full of water (r=60 cm, h=180 cm). Find the water left in the cylinder.

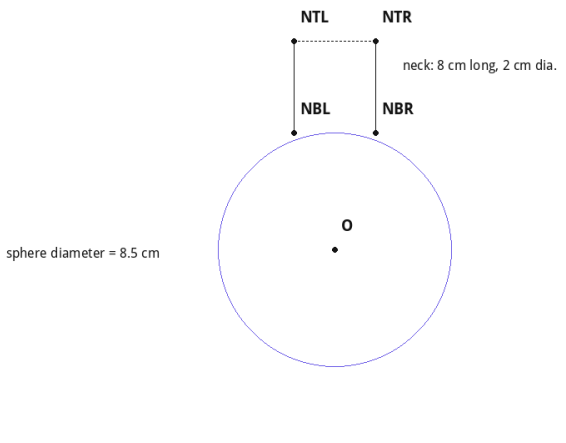


Cone (h=120 cm) on hemisphere (r=60 cm), both r=60 cm, standing inside a water-filled cylinder (r=60 cm, h=180 cm).

Cone (h=120 cm) on hemisphere (r=60 cm), both r=60 cm, standing inside a water-filled cylinder (r=60 cm, h=180 cm).

Solution: Cylinder volume = π(3600)(180) = 648000π. Cone + hemisphere = 144000π + 144000π = 288000π. Water left = 648000π − 288000π = 360000π = 360000×22/7 ≈ **1,131,428.57 cm³ (≈1.131 m³).**

Q8. A spherical vessel with a cylindrical neck (8 cm long, 2 cm diameter) and spherical part diameter 8.5 cm is measured by a child to hold 345 cm³. Using π = 3.14, check her answer.



Spherical vessel (diameter 8.5 cm) with a cylindrical neck (8 cm long, 2 cm diameter).

Solution: Sphere volume = (4/3)(3.14)(4.25)³ ≈ 321.39 cm³. Neck volume = 3.14×(1)²×8 = 25.12 cm³. Total ≈ **346.51 cm³** — very close to the child's measured 345 cm³, so her measurement is essentially correct within experimental/rounding error.

Why This Chapter Matters for Boards

Surface Areas and Volumes typically contributes 6-8 marks to the Class 10 Maths board paper, almost always as one long-answer combination-of-solids question. Examiners particularly like the "convert one shape into another, keeping volume constant" style of reasoning, so make sure the Extra Questions/HOTS companion post below is not skipped — several of its questions are built exactly around that reasoning pattern.