SURFACE AREAS AND VOLUMES

Complete Study Material for CBSE Class 10 (2025-26)

Chapter 12

🌟 FASCINATING FACTS ABOUT SURFACE AREAS

AND VOLUMES

Did You Know?

🏺 **Archimedes' Eureka Moment:** The famous mathematician Archimedes discovered the principle of volume displacement while taking a bath! He shouted "Eureka!" (I found it!) and ran through the streets of Syracuse!

🏛️ **Ancient Architecture:** Ancient Egyptians calculated volumes of pyramids to determine the amount of stone needed. The Great Pyramid of Giza contains approximately 2.3 million stone blocks!

🏸 **Sports Science:** Cricket balls, footballs, and tennis balls are designed using precise surface area and volume calculations to ensure perfect bounce, speed, and aerodynamics!

🏗️ **Modern Marvels:** The Burj Khalifa, world's tallest building, required complex surface area calculations for its glass facade (over 1.5 million square feet of glass!) and volume calculations for concrete (110,000 tons!)!

💊 **Medical Applications:** Pharmaceutical companies use surface area calculations to determine how quickly medicines dissolve in the body. Capsules and tablets are designed using these principles!

🚢 **Ship Design:** Naval architects calculate the volume of ships to determine buoyancy. The volume of displaced water equals the weight of the ship - this is Archimedes' Principle in action!

🏺 **Pottery & Art:** Artisans and potters have used volume calculations for thousands of years to create perfectly proportioned vessels, vases, and sculptures!

🌊 **Water Conservation:** Water tank designers use these concepts to create tanks that maximize volume while minimizing surface area (to reduce evaporation and material costs)!

🎨 **3D Printing:** Modern 3D printers calculate the exact volume of material needed for each object. Surface area calculations determine printing time and

cost!

🍕 **Food Industry:** Pizza boxes, ice cream cones, and food packaging are all designed using surface area and volume mathematics to optimize size, cost, and freshness!

📋 CHAPTER OVERVIEW

🎯 **What You Will Learn:**

- ✓ Understanding combination of basic solids (cuboid, cone, cylinder, sphere, hemisphere)
- ✓ Calculating surface areas of combined solids
- ✓ Finding volumes of combined solids
- ✓ Real-life applications of these concepts
- ✓ Problem-solving strategies for complex shapes

📊 **Chapter Weightage:** 10 Marks (Board Exam)

⏰ **Study Time Required:** 12-15 hours for complete mastery

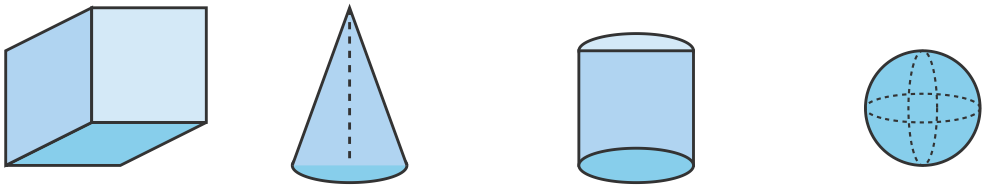
🎓 **Difficulty Level:** Moderate to High

📝 **Types of Questions:** 2 marks, 3 marks, 4 marks (including word problems)

🔍 12.1 INTRODUCTION

From Class IX, you are familiar with basic solids like **cuboid, cone, cylinder, and sphere**. You have learned how to find their surface areas and volumes.

Basic Solids We Know



Cuboid | Cone | Cylinder | Sphere

In our day-to-day life, we come across many objects that are made by combining two or more basic solids. For example:

🌟 Real-Life Examples:

- 🚚 **Truck containers:** Cylinder with two hemispheres at ends (oil/water tankers)
- 🧪 **Test tubes:** Combination of cylinder and hemisphere
- 🍦 **Ice cream cones:** Cone with hemisphere on top
- 🏛️ **Monuments:** Various combinations creating beautiful structures
- 🪀 **Toys (Lattu):** Cone surmounted on hemisphere
- 🏺 **Decorative items:** Cube with hemisphere on top
- 🚀 **Rockets:** Cone mounted on cylinder

📐 BASIC FORMULAS - MUST MEMORIZE!

Formula Sheet for Quick Reference

Solid	Curved Surface Area (CSA)	Total Surface Area (TSA)	Volume
Cuboid (l × b × h)	Lateral Surface = 2h(l + b)	2(lb + bh + hl)	l × b × h
Cube (side = a)	$4a^2$	$6a^2$	a^3
Cylinder (r = radius, h = height)	$2\pi rh$	$2\pi r(r + h)$	πr^2h
Cone (r = radius, h = height, l = slant height)	πrl where $l = \sqrt{(r^2 + h^2)}$	$\pi r(r + l)$	$\frac{1}{3}\pi r^2h$
Sphere (r = radius)	$4\pi r^2$	$4\pi r^2$	$\frac{4}{3}\pi r^3$
Hemisphere (r = radius)	$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$

💡 Important Points to Remember:

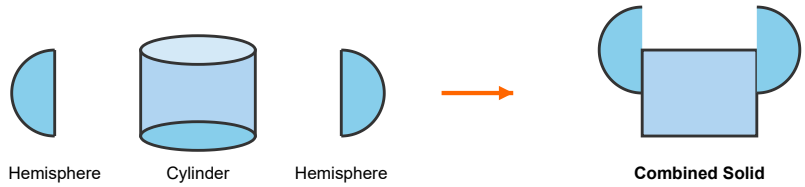
- Use **π = 22/7** unless question specifies otherwise
- **Slant height of cone:** $l = \sqrt{(r^2 + h^2)}$ - Never forget this!
- **TSA vs CSA:** TSA includes all surfaces, CSA excludes base(s)
- **Hemisphere:** Has flat circular base + curved surface
- **Units:** Surface area in cm^2 or m^2, Volume in cm^3 or m^3
- **1/3 factor:** Remember cone and pyramid volumes have 1/3

🎯 12.2 SURFACE AREA OF COMBINATION OF SOLIDS

KEY CONCEPT: When solids are combined, Total Surface Area = Sum of VISIBLE curved surface areas only. Hidden surfaces are NOT included!

📘 Type 1: Cylinder with Two Hemispheres (Capsule Shape)

How Combined Solid is Formed



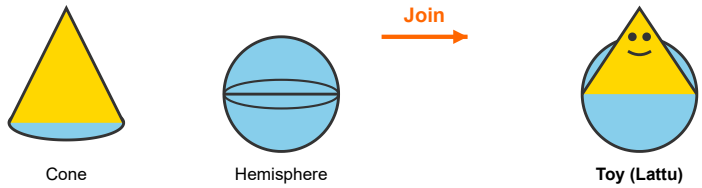
TSA = CSA of Hemisphere$_1$ + CSA of Cylinder + CSA of Hemisphere$_2$

$= 2\pi r^2 + 2\pi rh + 2\pi r^2$

$= 2\pi r(2r + h)$

📘 Type 2: Cone Surmounted on Hemisphere (Toy Shape)

Making a Toy



TSA = CSA of Hemisphere + CSA of Cone

$$= 2\pi r^2 + \pi rl$$

where $l = \sqrt{(r^2 + h^2)}$

⚠️ **IMPORTANT:** The base of cone and flat face of hemisphere are joined together, so we DON'T include their areas. We only calculate VISIBLE curved surfaces!

📘 Type 3: Hemisphere on Cube

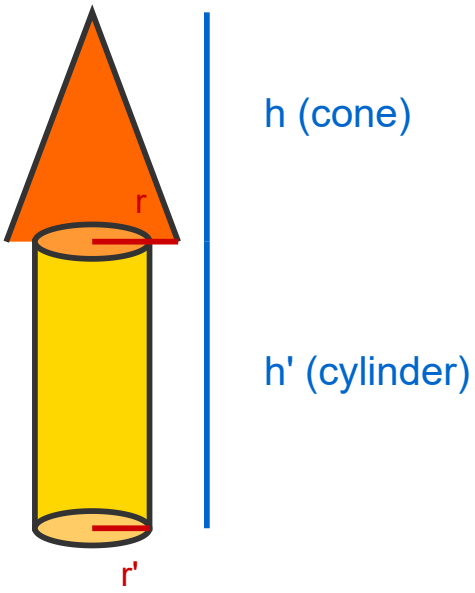
TSA = TSA of Cube - Base Area of Hemisphere + CSA of Hemisphere

$= 6a^2 - \pi r^2 + 2\pi r^2$

$= 6a^2 + \pi r^2$

📘 Type 4: Cone Mounted on Cylinder (Rocket Shape)

Toy Rocket



When r (cone) = r' (cylinder):

$$TSA = \pi rl + 2\pi r'h' + \pi r'^2$$

When r (cone) > r' (cylinder):

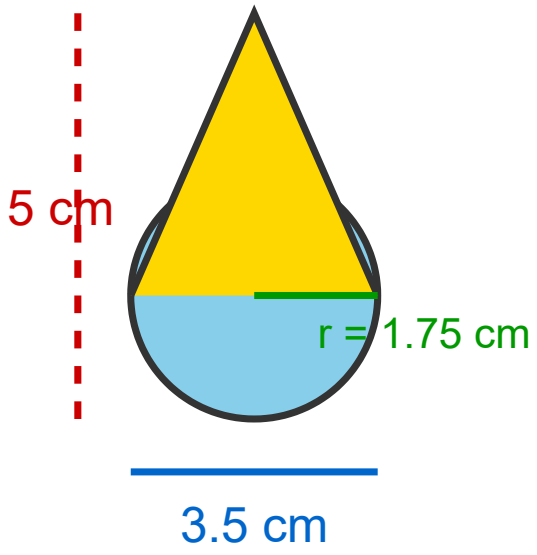
$$TSA = \pi rl + 2\pi r'h' + \pi r'^2 + \pi(r^2 - r'^2)$$

(Extra ring area is included)

SOLVED EXAMPLES - SURFACE AREA

Example 1: Playing Top (Lattu) - NCERT Example 1

Question: Rasheed got a playing top (lattu) as his birthday present. The top is shaped like a cone surmounted by a hemisphere. The entire top is 5 cm in height and the diameter is 3.5 cm. Find the area he has to colour. (Take π = 22/7)



Solution:

Given: Total height = 5 cm, Diameter = 3.5 cm, so radius r = 1.75 cm

Step 1: Calculate CSA of hemisphere

CSA of hemisphere = $2\pi r^2 = 2 \times (22/7) \times (1.75)^2$

$= 2 \times (22/7) \times (3.5/2) \times (3.5/2)$

$= (22 \times 3.5 \times 3.5)/(7 \times 2) = 269.5/14 =$ **$19.25\ cm^2$**

Step 2: Find height of cone

Height of cone = Total height - Radius of hemisphere

$h = 5 - 1.75 =$ **$3.25\ cm$**

Step 3: Find slant height of cone

$l = \sqrt{(r^2 + h^2)} = \sqrt{((1.75)^2 + (3.25)^2)}$

$= \sqrt{(3.0625 + 10.5625)} = \sqrt{13.625} \approx$ **$3.69\ cm$**

Step 4: Calculate CSA of cone

CSA of cone = $\pi rl = (22/7) \times 1.75 \times 3.69$

$\approx$ **$20.35\ cm^2$**

Step 5: Find total surface area

TSA = CSA of hemisphere + CSA of cone

$= 19.25 + 20.35 =$ **$39.6\ cm^2$**

Example 2: Decorative Block - NCERT Example 2

Question: A decorative block is made of two solids — a cube and a hemisphere. The base of the block is a cube with edge 5 cm, and the hemisphere fixed on top has a diameter of 4.2 cm. Find the total surface area of the block. (Take π = 22/7)

Solution:

Given: Edge of cube (a) = 5 cm, Diameter of hemisphere = 4.2 cm, so r = 2.1 cm

Step 1: TSA of cube = $6a^2 = 6 \times 5^2 = 150$ cm²

Step 2: Calculate combined surface area

TSA = TSA of cube - Base area of hemisphere + CSA of hemisphere

$= 6a^2 - \pi r^2 + 2\pi r^2 = 6a^2 + \pi r^2$

$= 150 + (22/7) \times (2.1)^2$

$= 150 + (22/7) \times 4.41$

$= 150 + 13.86$

$= \mathbf{163.86\ cm^2}$

Example 3: Wooden Toy Rocket - NCERT Example 3

Question: A wooden toy rocket is in the shape of a cone mounted on a cylinder. The height of the entire rocket is 26 cm, while the height of the conical part is 6 cm. The base of the conical portion has a diameter of 5 cm, while the base diameter of the cylindrical portion is 3 cm. If the conical portion is to be painted orange and the cylindrical portion yellow, find the area of the rocket painted with each colour. (Take $\pi = 3.14$)

Solution:

Given: Total height = 26 cm, h (cone) = 6 cm, r (cone) = 2.5 cm, r' (cylinder) = 1.5 cm, h' (cylinder) = 20 cm

Step 1: Find slant height of cone

$l = \sqrt{(r^2 + h^2)} = \sqrt{((2.5)^2 + 6^2)} = \sqrt{42.25} = 6.5$ cm

Step 2: Area to be painted ORANGE

Since r (cone) > r' (cylinder), there's a ring at junction:

Orange area = $\pi rl + \pi r^2 - \pi r'^2$

$= \pi[(2.5 \times 6.5) + (2.5)^2 - (1.5)^2]$

$= \pi \times 20.25 = 3.14 \times 20.25$

$=$ **63.585 cm²**

Step 3: Area to be painted YELLOW

Yellow area = $2\pi r'h' + \pi r'^2 = \pi r'(2h' + r')$

$= 3.14 \times 1.5 \times (40 + 1.5) = 4.71 \times 41.5$

$=$ **195.465 cm²**

Example 4: Bird-Bath - NCERT Example 4

Question: Mayank made a bird-bath for his garden in the shape of a cylinder with a hemispherical depression at one end. The height of the cylinder is 1.45 m and its radius is 30 cm. Find the total surface area of the bird-bath. (Take π = 22/7)

Solution:

Given: h = 1.45 m = 145 cm, r = 30 cm

TSA = CSA of cylinder + CSA of hemisphere

$= 2\pi rh + 2\pi r^2 = 2\pi r(h + r)$

$= 2 \times (22/7) \times 30 \times (145 + 30)$

$= 2 \times (22/7) \times 30 \times 175$

$= 33000\ cm^2$

$= \mathbf{3.3\ m^2}$

🎯 12.3 VOLUME OF COMBINATION OF SOLIDS

KEY CONCEPT: **When calculating volume of combined solids, we simply ADD the volumes of individual components. Unlike surface area, no part of volume is "hidden"!**

🔑 Golden Rule for Volume:

- ✓ Volume is ALWAYS additive - just add all volumes!
- ✓ No hidden parts - entire volume of each solid counts
- ✓ Use correct formula for each component
- ✓ Remember: Cone volume has 1/3 factor
- ✓ Convert all units before calculation

SOLVED EXAMPLES - VOLUME

Example 5: Industrial Shed - NCERT Example 5

Question: Shanta runs an industry in a shed which is in the shape of a cuboid surmounted by a half cylinder. If the base of the shed is of dimension 7 m × 15 m, and the height of the cuboidal portion is 8 m, find the volume of air that the shed can hold. Further, suppose the machinery occupies 300 m^3, and there are 20 workers, each occupying 0.08 m^3. How much air is in the shed? (Take π = 22/7)

Solution:

Given: Length = 15 m, Breadth = 7 m, Height of cuboid = 8 m, Diameter of half cylinder = 7 m (r = 3.5 m), Height of half cylinder = 15 m

Step 1: Volume of cuboid = l × b × h = 15 × 7 × 8 = 840 m^3

Step 2: Volume of half cylinder = (1/2) × $\pi r^2 h$

= (1/2) × (22/7) × $(3.5)^2$ × 15

= (1/2) × (22/7) × 12.25 × 15 = 288.75 m^3

Step 3: Total volume of shed = 840 + 288.75 = **1128.75 m^3**

Step 4: Space occupied = Machinery + Workers

= 300 + (20 × 0.08) = 300 + 1.6 = 301.6 m^3

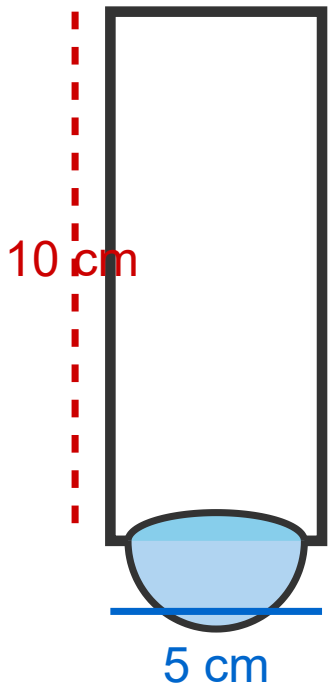
Step 5: Air volume remaining

= 1128.75 - 301.6

= **827.15 m^3**

Example 6: Juice Glass - NCERT Example 6

Question: A juice seller was serving customers using glasses with a hemispherical raised portion at the bottom. The inner diameter of the cylindrical glass was 5 cm, and the height was 10 cm. Find the apparent capacity and actual capacity of the glass. (Use π = 3.14)



Solution:

Given: Diameter = 5 cm, so r = 2.5 cm, Height = 10 cm

Step 1: Apparent capacity (without hemisphere)

= $\pi r^2 h = 3.14 \times (2.5)^2 \times 10$

= $3.14 \times 6.25 \times 10 =$ **$196.25\ cm^3$**

Step 2: Volume of hemisphere

= $(2/3)\pi r^3 = (2/3) \times 3.14 \times (2.5)^3$

= $(2/3) \times 3.14 \times 15.625 =$ **$32.71\ cm^3$**

Step 3: Actual capacity

= Apparent capacity - Volume of hemisphere

= 196.25 - 32.71

= **$163.54\ cm^3$**

💡 **Insight:** The hemispherical depression reduces capacity by about 16.67%. This clever design reduces the amount of juice served!

Example 7: Toy with Cone and Hemisphere - NCERT Example 7

Question: A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm and the diameter of the base is 4 cm. Determine the volume of the toy. If a right circular cylinder circumscribes the toy, find the difference of volumes. (Take $\pi = 3.14$)

Solution:

Given: Diameter = 4 cm, so r = 2 cm, Height of cone = 2 cm

Step 1: Volume of toy

= Volume of hemisphere + Volume of cone

$= (2/3)\pi r^3 + (1/3)\pi r^2 h$

$= (1/3)\pi r^2(2r + h)$

$= (1/3) \times 3.14 \times 4 \times (4 + 2)$

$= (1/3) \times 3.14 \times 24 =$ **$25.12\ cm^3$**

Step 2: Circumscribing cylinder dimensions

Radius = 2 cm, Height = 2 + 2 = 4 cm

Step 3: Volume of cylinder

$= \pi r^2 h = 3.14 \times 4 \times 4 =$ **$50.24\ cm^3$**

Step 4: Difference

= 50.24 - 25.12

= **$25.12\ cm^3$**

⚠️ COMMON MISTAKES TO AVOID

❌ Mistake 1: Adding Total Surface Areas

Wrong: TSA of toy = TSA of cone + TSA of hemisphere

Correct: TSA of toy = CSA of cone + CSA of hemisphere

Why? Base faces are hidden when joined!

❌ Mistake 2: Forgetting Slant Height Formula

Wrong: Using height directly in cone CSA

Correct: First calculate $l = \sqrt{(r^2 + h^2)}$, then use CSA = πrl

Why? Curved surface follows slant height!

❌ Mistake 3: Unit Conversion Errors

Wrong: Mixing cm and m in same calculation

Correct: Convert all to same unit first

Example: 1.45 m = 145 cm, not 1.45 cm!

❌ Mistake 4: Forgetting 1/3 Factor

Wrong: Volume of cone = $\pi r^2 h$

Correct: Volume of cone = $(1/3)\pi r^2 h$

Why? Cone is 1/3 of cylinder!

❌ Mistake 5: Wrong Hemisphere Formula

Wrong: Volume of hemisphere = $(4/3)\pi r^3$

Correct: Volume of hemisphere = $(2/3)\pi r^3$

Why? Hemisphere is half of sphere!

💡 SMART TIPS & TRICKS

🎯 Strategy 1: Draw Before Calculate

- Always draw a labeled diagram
- Mark all given dimensions
- Identify visible surfaces
- This prevents conceptual errors!

🎯 Strategy 2: Three-Step Approach

1. **Identify** the individual solids
2. **Calculate** required quantity for each
3. **Combine** appropriately (add for volume, selective for surface area)

🎯 Strategy 3: Use Factorization

Instead of: $2\pi r^2 + 2\pi rh$ (calculating separately)

Better: $2\pi r(r + h)$ (single calculation)

Saves time and reduces errors!

📖 EXERCISE 12.1 - SURFACE AREA PROBLEMS

Practice Questions (NCERT)

Q1. 2 cubes each of volume 64 cm^3 are joined end to end. Find the surface area of the resulting cuboid.

Q2. A vessel is in the form of 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.

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

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

Q5. A hemispherical depression is cut out from one face of a cubical wooden block such that the diameter l of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.

Q6. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter is 5 mm. Find its surface area.

Q7. A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are 2.1 m and 4 m respectively, and the slant height of the top is 2.8 m, find the area of canvas used for making the tent. Also, find the cost of canvas at ₹500 per m^2.

Q8. From a solid cylinder whose height is 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 to the nearest cm^2.

Q9. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder. If the height of the cylinder is 10 cm, and its base radius is

3.5 cm, find the total surface area of the article.

📖 EXERCISE 12.2 - VOLUME PROBLEMS

Practice Questions (NCERT)

Q1. A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π.

Q2. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends. The diameter of the model is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model.

Q3. A gulab jamun contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm.

Q4. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each depression is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand.

Q5. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped.

Q6. A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, which is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8g mass. (Use π = 3.14)

Q7. A solid consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm is placed upright in a right circular cylinder full of water such that it touches the bottom. Find the volume

of water left in the cylinder, if the radius of the cylinder is 60 cm and its height is 180 cm.

Q8. A spherical glass vessel has a cylindrical neck 8 cm long, 2 cm in diameter; the diameter of the spherical part is 8.5 cm. By measuring the amount of water it holds, a child finds its volume to be 345 cm^3. Check whether she is correct.

🚀 LAST MINUTE REVISION CHECKLIST

☑ Theory to Remember:

- ☑ All basic formulas (cuboid, cone, cylinder, sphere, hemisphere)
- ☑ Slant height formula: $l = \sqrt{(r^2 + h^2)}$
- ☑ Difference between TSA and CSA
- ☑ When to add surface areas, when NOT to
- ☑ Volume is always additive
- ☑ Common combinations and their properties

☑ Quick Checks Before Writing Answer:

- ☑ Did I draw a diagram with labels?
- ☑ Are all units converted to same system?
- ☑ Did I use correct formula for each solid?
- ☑ For surface area: Did I identify visible surfaces only?
- ☑ For cone: Did I calculate slant height first?
- ☑ Did I use correct value of π (22/7 or 3.14)?
- ☑ Are my calculations correct (double-check)?
- ☑ Is final answer with proper units?
- ☑ Did I answer what was asked?

☑ Common Question Types:

- ☑ Finding surface area of combined solids
- ☑ Calculating volume of combined solids
- ☑ Problems with depression/cavity
- ☑ Conversion problems (melting and recasting)
- ☑ Application problems (tanks, toys, buildings)
- ☑ Cost calculation problems
- ☑ Capacity/volume-left problems

☑ Before Exam:

- ☑ Memorize all basic formulas perfectly
- ☑ Practice at least 50 problems
- ☑ Solve last 5 years' board questions
- ☑ Review all worked examples
- ☑ Go through common mistakes list
- ☑ Time yourself - 3-10 min per question
- ☑ Revise NCERT examples thoroughly
- ☑ Practice both numerical and word problems

💡 EXPERT TIPS FOR SCORING FULL MARKS

How to Score 100% in Surface Areas and Volumes:

- **1. Master the basics:** All individual solid formulas must be at fingertips
- **2. Draw always:** Visual representation prevents conceptual errors
- **3. Formula first:** Write the formula before substituting values
- **4. Show ALL steps:** Board exams award step marks generously
- **5. Unit consistency:** Convert all measurements to same unit first
- **6. For surface area:** Think what's VISIBLE, not total
- **7. For volume:** Just add the volumes - simple!
- **8. Slant height:** Don't forget to calculate for cone problems
- **9. π value:** Use exactly as specified in question
- **10. Box final answer:** Make it stand out clearly
- **11. Check reasonability:** Does the answer make sense?
- **12. Practice variations:** Same concept, different combinations
- **13. Learn from mistakes:** Maintain an error log
- **14. Time management:** Allocate 6-8 minutes per 4-mark question
- **15. Revision strategy:** Solve 10 problems daily for 15 days

🎯 MARKING SCHEME - HOW TO GET FULL MARKS

Understanding Board Exam Marking (4 Marks Question)

Step	Marks	What to Write
Correct formula	1 mark	Write the exact formula you'll use
Correct substitution	1 mark	Put values in formula correctly
Correct calculation	1 mark	Show step-by-step arithmetic
Final answer with units	1 mark	Correct answer with proper units

Pro Tip: Even if final answer is wrong, you can still score 3/4 marks if your method is correct!

📚 CHAPTER SUMMARY

Key Takeaways

1. **Combination of Solids:** Real objects are often combinations of basic solids
2. **Surface Area Rule:** TSA = Sum of VISIBLE curved surface areas only
3. **Volume Rule:** Volume = Sum of all individual volumes
4. **Common Combinations:**
   - Cone on hemisphere (toys)
   - Cylinder with hemispheres (capsules)
   - Cone on cylinder (rockets)
   - Hemisphere on cube (decorative)
5. **Key Formulas:**
   - Slant height: $l = \sqrt{(r^2 + h^2)}$
   - Cone volume = 1/3 of cylinder volume
   - Hemisphere volume = $(2/3)\pi r^3$
6. **Problem-Solving Strategy:**
   - Draw and label diagram
   - Identify individual solids
   - Apply appropriate formulas
   - Combine results correctly
   - Verify answer with units

Final Words of Wisdom

"Practice + Precision + Patience = Perfect Score"

This chapter is highly scoring if you:

- ✓ Have strong command over basic formulas
- ✓ Can identify and visualize combinations
- ✓ Are careful with calculations
- ✓ Practice diverse problem types
- ✓ Show complete working in exams

Expected Questions in Board Exam:

- 2-3 questions worth 8-10 marks total
- Mix of 2-mark, 3-mark, and 4-mark questions
- 1 case study question (4 marks) possible
- Focus on practical applications

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