

HEMISPHERES & RIGHT CIRCULAR CYLINDER

Complete SSC CGL Examination Notes

Comprehensive Guide with Formulas & Examples • Created by GovtExamPrep

1. HEMISPHERE - BASIC CONCEPTS

Definition & Properties

Hemisphere: A hemisphere is exactly half of a sphere, formed when a sphere is cut by a plane passing through its center.

[Diagram: Hemisphere showing radius, curved surface, and circular base]

Property	Description	Formula
Radius	Distance from center to any point on surface	r
Curved Surface Area	Area of the rounded part only	$2\pi r^2$
Total Surface Area	Curved surface + Base area	$3\pi r^2$
Volume	Space occupied by the hemisphere	$(2/3)\pi r^3$

Hemisphere Formulas

Curved Surface Area (CSA):

$$CSA = 2\pi r^2$$

Total Surface Area (TSA):

$$TSA = \text{Curved Surface Area} + \text{Base Area}$$

$$TSA = 2\pi r^2 + \pi r^2 = 3\pi r^2$$

Volume:

$$\text{Volume} = (2/3)\pi r^3$$

Example: Find curved surface area, total surface area, and volume of a hemisphere with radius 7 cm

Solution:

- Radius $r = 7$ cm

- Curved Surface Area = $2\pi r^2 = 2 \times (22/7) \times 7^2 = 2 \times (22/7) \times 49 = 308 \text{ cm}^2$
- Total Surface Area = $3\pi r^2 = 3 \times (22/7) \times 49 = 462 \text{ cm}^2$
- Volume = $(2/3)\pi r^3 = (2/3) \times (22/7) \times 7^3 = (2/3) \times (22/7) \times 343 = 1437.33 \text{ cm}^3$

2. RIGHT CIRCULAR CYLINDER - BASIC CONCEPTS

Definition & Properties

Right Circular Cylinder: A solid with two parallel circular bases connected by a curved surface, where the axis is perpendicular to the bases.

[Diagram: Cylinder showing radius, height, and different surfaces]

Property	Description	Formula
Radius	Radius of circular base	r
Height	Distance between two bases	h
Curved Surface Area	Area of the curved surface only	$2\pi rh$
Total Surface Area	Curved surface + 2 × Base area	$2\pi r(h + r)$
Volume	Space occupied by the cylinder	$\pi r^2 h$

Cylinder Formulas

Curved Surface Area (CSA):

$$CSA = 2\pi rh$$

Total Surface Area (TSA):

$$TSA = \text{Curved Surface Area} + 2 \times \text{Base Area}$$

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

Volume:

$$\text{Volume} = \text{Base Area} \times \text{Height} = \pi r^2 h$$

Example: Find curved surface area, total surface area, and volume of a cylinder with radius 7 cm and height 10 cm

Solution:

- Radius $r = 7$ cm, Height $h = 10$ cm

- Curved Surface Area = $2\pi rh = 2 \times (22/7) \times 7 \times 10 = 440 \text{ cm}^2$
- Total Surface Area = $2\pi r(h + r) = 2 \times (22/7) \times 7 \times (10 + 7) = 748 \text{ cm}^2$
- Volume = $\pi r^2 h = (22/7) \times 7^2 \times 10 = 1540 \text{ cm}^3$

3. COMPARISON & RELATIONSHIPS

Volume Relationships

Important Relationships:

- Volume of Cylinder : Volume of Hemisphere = 3 : 2 (same radius)
- Volume of Sphere : Volume of Hemisphere = 2 : 1
- Volume of Cone : Volume of Hemisphere = 1 : 2 (same radius and height = radius)

Example: A hemisphere and cylinder have same radius. If cylinder height equals radius, find ratio of their volumes

Solution:

- Volume of Hemisphere = $(2/3)\pi r^3$
- Volume of Cylinder = $\pi r^2 h = \pi r^2 \times r = \pi r^3$ (since $h = r$)
- Ratio = Hemisphere : Cylinder = $(2/3)\pi r^3 : \pi r^3 = 2/3 : 1 = \mathbf{2:3}$

Surface Area Relationships

Situation	Relationship	Condition
Cylinder & Hemisphere CSA	$CSA_{\text{cylinder}} = (h/r) \times CSA_{\text{hemisphere}}$	Same radius
Cylinder & Hemisphere TSA	$TSA_{\text{cylinder}} = [2(h+r)/(3r)] \times TSA_{\text{hemisphere}}$	Same radius
Equal Volumes	$h = (2/3)r$	Cylinder height when volumes equal
Equal Surface Areas	$2\pi r(h+r) = 3\pi r^2 \Rightarrow h = r/2$	Cylinder height when TSA equal

4. HOLLOW CYLINDERS & COMPOSITE SHAPES

Hollow Cylinder

Hollow Cylinder: A cylinder with a hollow portion inside, characterized by inner and outer radii.

Hollow Cylinder Formulas:

Let R = outer radius, r = inner radius, h = height

Volume of Material:

$$\text{Volume} = \pi(R^2 - r^2)h$$

Total Surface Area:

$$\text{TSA} = 2\pi(R + r)(h + R - r)$$

Curved Surface Area:

$$\text{CSA} = 2\pi h(R + r)$$

Example: A hollow cylinder has outer radius 8 cm, inner radius 6 cm, height 10 cm. Find volume of material

Solution:

- Outer radius $R = 8$ cm, Inner radius $r = 6$ cm, Height $h = 10$ cm
- Volume = $\pi(R^2 - r^2)h = (22/7) \times (8^2 - 6^2) \times 10$
- = $(22/7) \times (64 - 36) \times 10 = (22/7) \times 28 \times 10 = 880 \text{ cm}^3$

Composite Shapes

Common Composite Shapes:

- Cylinder with hemispherical ends (Capsule shape)
- Hemisphere placed on cylinder
- Cylinder inside hemisphere or vice versa

Example: A capsule consists of a cylinder with two hemispheres at both ends. Cylinder height = 10 cm, radius = 3.5 cm. Find total volume

Solution:

- Volume of cylinder = $\pi r^2 h = (22/7) \times (3.5)^2 \times 10 = 385 \text{ cm}^3$
- Volume of two hemispheres = $2 \times (2/3)\pi r^3 = (4/3)\pi r^3$
- = $(4/3) \times (22/7) \times (3.5)^3 = 179.67 \text{ cm}^3$
- Total volume = $385 + 179.67 = \mathbf{564.67 \text{ cm}^3}$

5. PRACTICAL APPLICATIONS & PROBLEM TYPES

Common Problem Types

Type 1: Dimension Changes

- Radius/height increased/decreased by percentage
- Effect on volume/surface area

Type 2: Melting & Recasting

- Solid melted and recast into different shape
- Volume remains constant

Type 3: Painting/Costing

- Finding cost of painting surface
- Rate given per unit area

Type 4: Capacity Problems

- Finding how much liquid a container can hold
- Conversion between units

Solved Examples

Problem 1: If radius of cylinder is doubled and height halved, what happens to volume?

Solution:

- Original volume $V = \pi r^2 h$
- New radius = $2r$, New height = $h/2$
- New volume = $\pi(2r)^2 \times (h/2) = \pi \times 4r^2 \times h/2 = 2\pi r^2 h$
- Volume becomes **2 times** original

Problem 2: A hemisphere of lead is melted to form cylinder of same radius. Find height of cylinder

Solution:

- Volume of hemisphere = $(2/3)\pi r^3$
- Volume of cylinder = $\pi r^2 h$

- Since volume equal: $(2/3)\pi r^3 = \pi r^2 h$
- $h = (2/3)r = \mathbf{2r/3}$

6. SSC CGL PRACTICE PROBLEMS

Previous Year Question Types

Problem 1: The curved surface area of a hemisphere is 2772 cm^2 . Find its radius

Detailed Solution:

- Curved Surface Area of hemisphere = $2\pi r^2 = 2772$
- $2 \times (22/7) \times r^2 = 2772$
- $(44/7) \times r^2 = 2772$
- $r^2 = (2772 \times 7)/44 = 441$
- $r = \sqrt{441} = \mathbf{21 \text{ cm}}$

Problem 2: Volume of a cylinder is 3234 cm^3 and height is 21 cm. Find its curved surface area

Detailed Solution:

- Volume = $\pi r^2 h = 3234$
- $(22/7) \times r^2 \times 21 = 3234$
- $66 \times r^2 = 3234$
- $r^2 = 3234 \div 66 = 49$
- $r = 7 \text{ cm}$
- Curved Surface Area = $2\pi r h = 2 \times (22/7) \times 7 \times 21 = \mathbf{924 \text{ cm}^2}$

Problem 3: A hemispherical bowl has radius 14 cm. Find cost of painting its inner surface at ₹0.5 per cm^2

Detailed Solution:

- Inner surface area = $2\pi r^2 = 2 \times (22/7) \times 14^2$
- $= 2 \times (22/7) \times 196 = 1232 \text{ cm}^2$
- Cost = $1232 \times 0.5 = \mathbf{₹616}$

7. QUICK FORMULAS & SHORTCUTS

Memory Tips

Hemisphere Formulas:

- $CSA = 2\pi r^2$ (Think: "2 circles")
- $TSA = 3\pi r^2$ (Think: "3 circles")
- $Volume = (2/3)\pi r^3$ (Think: "2/3 of sphere")

Cylinder Formulas:

- $CSA = 2\pi rh$ (Think: "rectangle wrapped around")
- $TSA = 2\pi r(h + r)$ (Think: "CSA + 2 circles")
- $Volume = \pi r^2 h$ (Think: "area of circle $\times$ height")

Quick Calculations:

- $\pi \approx 22/7$ or 3.14
- $r^2 = (r \times r)$
- $r^3 = (r \times r \times r)$

Important Values

Radius	Hemisphere CSA	Hemisphere Volume	Cylinder CSA (h=10)	Cylinder Volume (h=10)
7 cm	308 cm ²	718.67 cm ³	440 cm ²	1540 cm ³
14 cm	1232 cm ²	5749.33 cm ³	880 cm ²	6160 cm ³
21 cm	2772 cm ²	19404 cm ³	1320 cm ²	13860 cm ³

8. SSC CGL PREPARATION STRATEGY

Expected Marks Distribution

Topic	Frequency	Difficulty	Marks Weightage
Hemisphere Problems	Medium	Medium	1-2 marks
Cylinder Problems	High	Easy-Medium	2-3 marks
Composite Shapes	Low	Hard	1 mark
Comparison Problems	Medium	Medium	1-2 marks
Practical Applications	High	Medium	2-3 marks

20-Day Study Plan

Week 1: Foundation Building

- Days 1-3: Hemisphere concepts & formulas
- Days 4-6: Cylinder concepts & formulas
- Days 7-10: Practice basic problems

Week 2-3: Advanced Practice

- Days 11-13: Composite shapes & applications
- Days 14-16: Previous year questions
- Days 17-20: Mock tests & revision

Daily Practice: 5 hemisphere problems, 5 cylinder problems, learn all formulas, practice unit conversions.

Hemispheres & Right Circular Cylinder - SSC CGL Master Notes

Comprehensive Guide with Formulas & Examples • Created by GovtExamPrep

© GovtExamPrep - All educational rights reserved.

This content may be freely distributed for educational purposes.