

Exercise 20(F)

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1. From a solid right circular cylinder with height 10 cm and radius of the base 6 cm, a right circular cone of the same height and same base are removed. Find the volume of the remaining solid.

Solution:

Given,

Height of the cylinder (h) = 10 cm

And radius of the base (r) = 6 cm

Volume of the cylinder = $\pi r^2 h$

Height of the cone = 10 cm

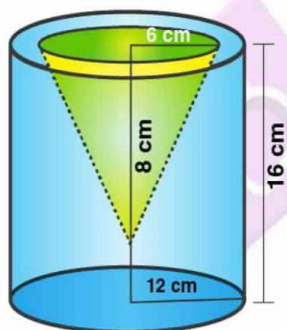
Radius of the base of cone = 6 cm

Volume of the cone = $\frac{1}{3} \pi r^2 h$

$$\begin{aligned}\text{Volume of the remaining part} &= \pi r^2 h - \frac{1}{3} \pi r^2 h \\ &= \frac{2}{3} \pi r^2 h \\ &= \frac{2}{3} \times \frac{22}{7} \times 6 \times 6 \times 10 \\ &= 5280/7 \text{ cm}^3 \\ &= 754 \frac{2}{7} \text{ cm}^3\end{aligned}$$

2. From a solid cylinder whose height is 16 cm and radius is 12 cm, a conical cavity of height 8 cm and of base radius 6 cm is hollowed out. Find the volume and total surface area of the remaining solid.

Solution:



Given,

Radius of solid cylinder (R) = 12 cm

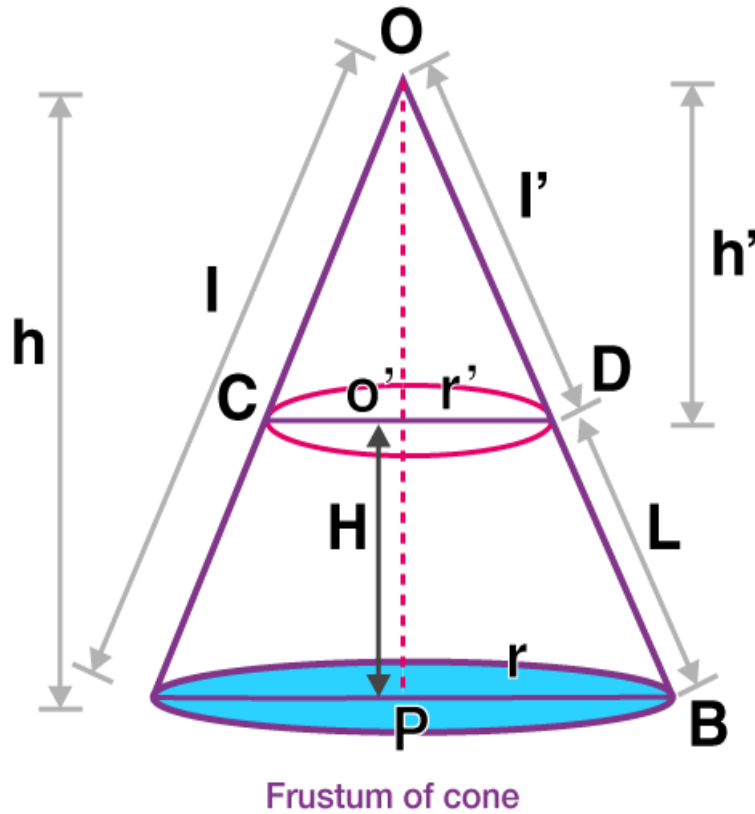
And, Height (H) = 16 cm

$$\begin{aligned}\text{Volume} &= \pi R^2 h = \frac{22}{7} \times 12 \times 12 \times 16 \\ &= 50688/7 \text{ cm}^3\end{aligned}$$

Also given,

Radius of cone (r) = 6 cm, and height (h) = 8 cm.

$$\begin{aligned}\text{Volume} &= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 8 \\ &= 2112/7 \text{ cm}^3\end{aligned}$$



Introduction | ପରିଚୟ English

Mensuration deals with the **measurement of length, area, surface area, and volume** of geometrical figures like **cube, cuboid, cylinder, cone, sphere, and frustum**.

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Mensuration ହେଉଛି ଘନ, ଘନାଋତ, ଶିଳିଣ୍ଡର, କୋନ୍, ଗୋଲକ ଓ ଫ୍ରଷ୍ଟମ୍ ପରି ଆକୃତିମାନଙ୍କର ପୃଷ୍ଠ ତଳଫଳ ଓ ଆୟତନ ମାପିବା ସହିତ ସଂପୃକ୍ତ ଅଧ୍ୟାୟ।

1. Surface Area & Volume of Cube | ଘନ Formulae | ସୂତ୍ର

- $TSA = 6a^2$
- $LSA = 4a^2$
- $Volume = a^3$

Example (3 Marks) English

Find the volume of a cube of side 7 cm.

$$V = 7^3 = 343 \text{ cm}^3$$

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ଘନର ଆୟତନ = 343 ଘ.ମି^୩

2. Cuboid | ଘନାକ୍ଷର

Formulae

- $TSA = 2(lb+bh+hl)$
- $LSA = 2h(l+b)$
- $Volume = lbhl$

Example (3 Marks)

A cuboid of dimensions 5 cm, 4 cm, 3 cm

$$V = 5 \times 4 \times 3 = 60 \text{ cm}^3$$

3. Cylinder | ଶିଳିଣ୍ଡର

Formulae

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

Example (5 Marks – Very Important)

English

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

$$V = \frac{22}{7} \times 7 \times 7 \times 10 = 1540 \text{ cm}^3$$

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ଶିଳିଣ୍ଡରର ଆୟତନ = 1540 ଘ.ମି^୩

4. Cone | କୋନ୍

Important Relations

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

Formulae

- $CSA = \pi rl$
- $TSA = \pi r(l+r)$
- $Volume = \frac{1}{3} \pi r^2 h$

Example (5 Marks)

Radius = 7 cm, Height = 24 cm

$$l = \sqrt{49 + 576} = 25$$

$$V = \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 24 = 1232 \text{ cm}^3$$

$$s^2 = 1232 \text{ cm}^3 V = 31 \times 722 \times 7 \times 7 \times 24 = 1232 \text{ cm}^3$$

5. Sphere | ଗୋଲକ

Formulae

- Surface Area = $4\pi r^2$
- Volume = $\frac{4}{3}\pi r^3$

Example (3 Marks)

Radius = 7 cm

$$V = \frac{4}{3} \times 22 \times 7^3 = 1437.33 \text{ cm}^3$$

6. Hemisphere | ଅର୍ଦ୍ଧଗୋଲକ

Formulae

- CSA = $2\pi r^2$
- TSA = $3\pi r^2$
- Volume = $\frac{2}{3}\pi r^3$

7. Frustum of a Cone | କୋନର ଫ୍ରଷ୍ଟମ୍

Formulae (VERY IMPORTANT – 5 Marks)

- CSA = $\pi l(R+r)$
- TSA = $\pi l(R+r) + \pi(R^2+r^2)$
- Volume = $\frac{1}{3}\pi h(R^2+r^2+Rr)$

BOARD-PATTERN QUESTIONS (MENSURATION)

MCQs (1 Mark)

Q. Volume of sphere is proportional to?

Ans: Cube of radius

ଉତ୍ତର: ଛୁଞ୍ଚିବ ଗୁଣିତା

VSA (2 Marks)

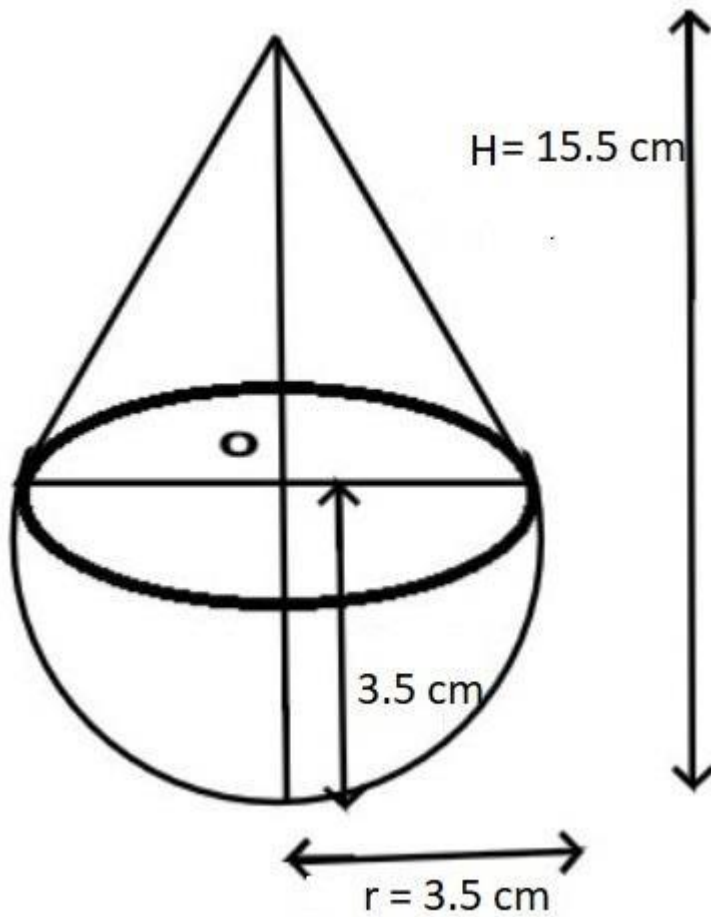
Q. Write formula for curved surface area of cone.

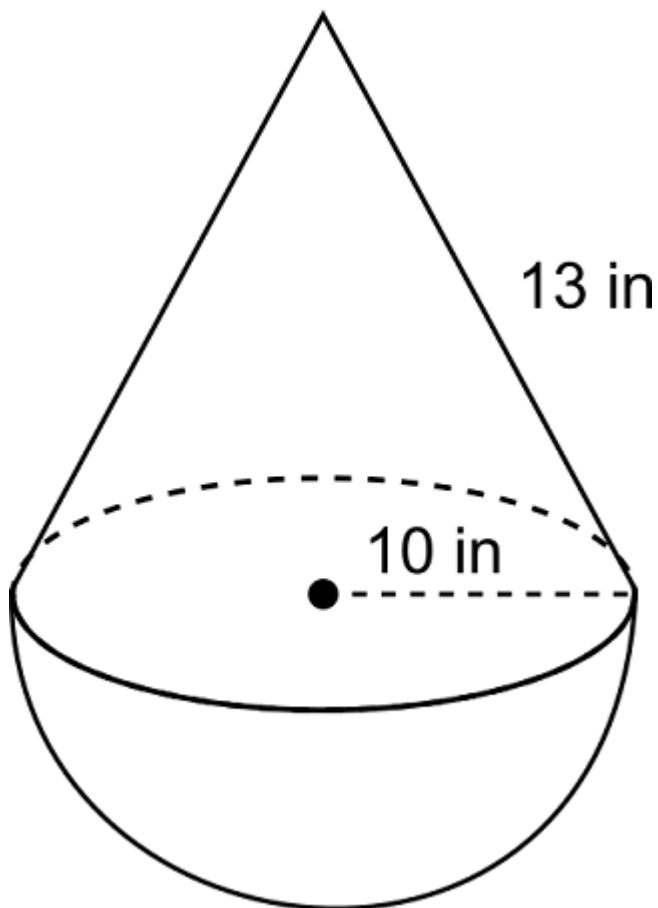
$$CSA = \pi r l$$

Question

A solid is composed of a cone mounted on a hemisphere. Find the volume of the solid.

(Given: radius = r , height of cone = h)





SOLUTION (Board Pattern)

Step-1: Diagram

(A cone mounted on a hemisphere having the same radius r)

Same base radius for both cone and hemisphere

Step-2: Formula Used

English

- Volume of cone

$$V_{\text{cone}} = \frac{1}{3} \pi r^2 h \quad V_{\text{cone}} = \frac{1}{3} \pi (10)^2 (12) = 1200\pi$$

- Volume of hemisphere

$$V_{\text{hemisphere}} = \frac{2}{3} \pi r^3 \quad V_{\text{hemisphere}} = \frac{2}{3} \pi (10)^3 = \frac{2000}{3} \pi$$

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- କୋନର ଆୟତନ

$$V_{\text{କୋନ}} = \frac{1}{3} \pi r^2 h \quad V_{\text{କୋନ}} = \frac{1}{3} \pi (10)^2 (12) = 1200\pi$$

- ଅର୍ଧଗୋଲକର ଆୟତନ

$$V_{\text{ଅର୍ଧଗୋଲକ}} = \frac{2}{3}\pi r^3 \quad V_{\text{ଅର୍ଧଗୋଲକ}} = \frac{2}{3}\pi r^3$$

Step-3: Calculation

English

Total Volume of solid

$$V = V_{\text{cone}} + V_{\text{hemisphere}} \\ V = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3 \\ V = \pi r^2 \left(\frac{h}{3} + \frac{2r}{3} \right) \\ V = \frac{\pi}{3} (r^2 h + 2r^3)$$

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ଘନର ସମ୍ପୂର୍ଣ୍ଣ ଆୟତନ

$$V = V_{\text{କୋନ୍}} + V_{\text{ଅର୍ଧଗୋଲକ}} \\ V = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3 \\ V = \pi r^2 \left(\frac{h}{3} + \frac{2r}{3} \right) \\ V = \frac{\pi}{3} (r^2 h + 2r^3)$$

Step-4: Final Answer

Final Answer (with unit)

$$V = \frac{\pi}{3} (r^2 h + 2r^3) \text{ cubic units} \\ V = \frac{\pi}{3} (r^2 h + 2r^3) \text{ cubic units}$$

Examiner's Marking Scheme (5 Marks)

Step	Marks
Neat diagram	1
Correct formula	1
Proper substitution	2
Final answer with unit	1
Total	5 / 5

Common Mistakes (Avoid These)

Writing cone & hemisphere with different radius

Missing π

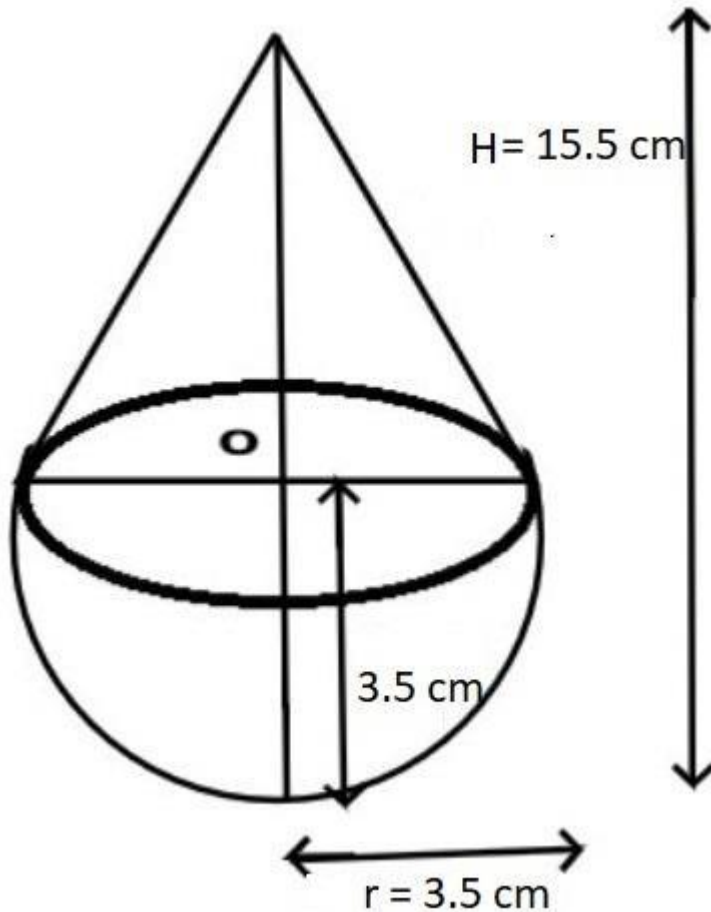
No unit in final answer

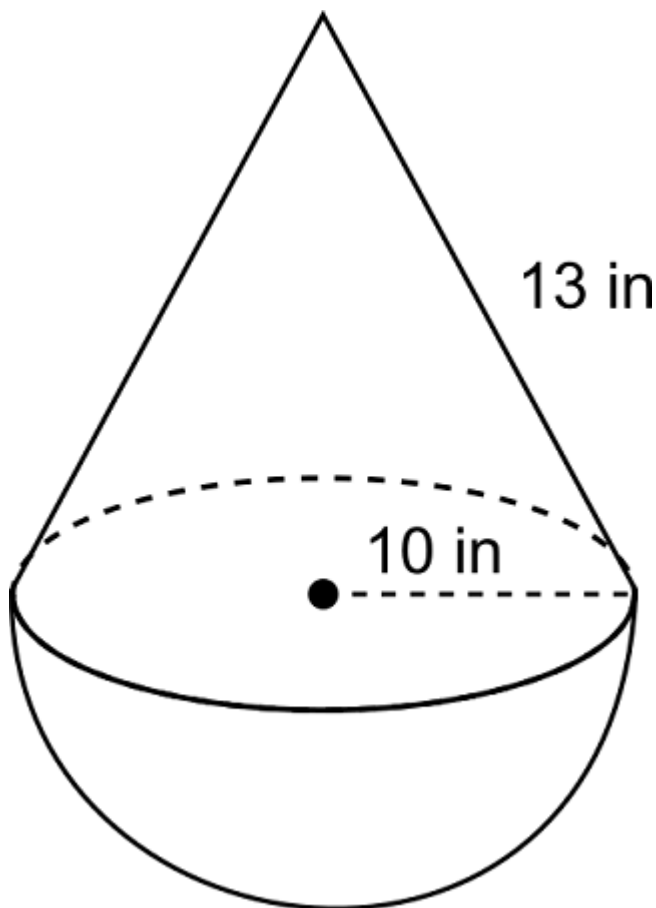
Skipping diagram

A. SAME QUESTION (WITH NUMERICAL VALUES) — 5 MARKS

Question

A solid is composed of a cone mounted on a hemisphere. If the **radius = 7 cm** and **height of the cone = 24 cm**, find the **volume of the solid**.





Solution (Board Pattern)

Step-1: Diagram

Cone and hemisphere have the **same radius** ($r = 7 \text{ cm}$).

Step-2: Formula

English

- Volume of cone $= \frac{1}{3}\pi r^2 h = 31\pi r^2 h$
- Volume of hemisphere $= \frac{2}{3}\pi r^3 = 32\pi r^3$

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- କୋନ୍ର ଆୟତନ $= \frac{1}{3}\pi r^2 h = 31\pi r^2 h$
- ଅର୍ଦ୍ଧଗୋଲକର ଆୟତନ $= \frac{2}{3}\pi r^3 = 32\pi r^3$

Step-3: Calculation

$V_{\text{cone}} = \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 24 = \frac{1}{3} \times 22 \times 7 \times 24 = 1232 \text{ cm}^3$
 $V_{\text{hemisphere}} = \frac{2}{3} \times \frac{22}{7} \times 7^3 = \frac{2}{3} \times 22 \times 49 = 718.67 \text{ cm}^3$
 $V_{\text{total}} = 1232 + 718.67 = 1950.67 \text{ cm}^3$

Final Answer

1950.67 cm^3

ପରିଣାମ (ଓଡ଼ିଆ)

ଘନର ସମ୍ପୂର୍ଣ୍ଣ ଆୟତନ = **1950.67 ସେ.ମି³**

Examiner's Marks (5/5): Diagram (1) + Formula (1) + Steps (2) + Unit (1)

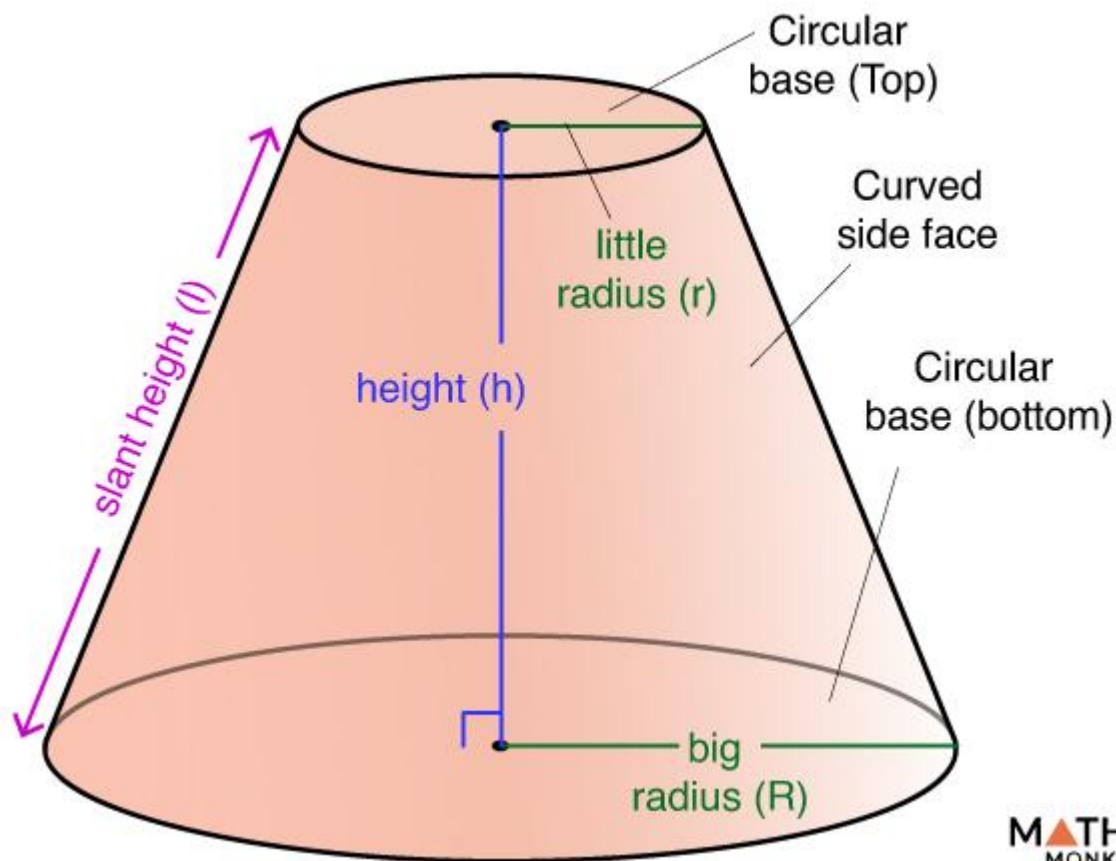
B. FRUSTUM + HEMISPHERE — SURE 5-MARK QUESTION

Question

A **frustum of a cone** is mounted on a **hemisphere**.

Given: $R=7$ cm, $r=3.5$ cm, height of frustum $h=10$ cm.

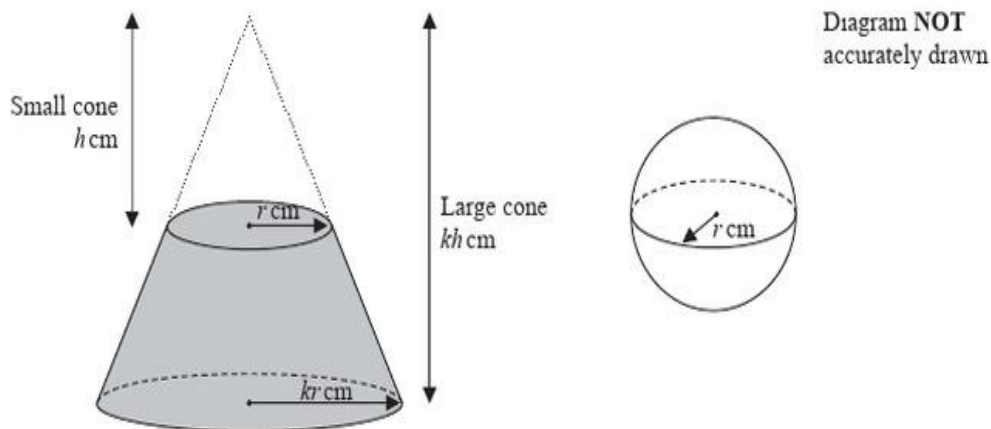
Find the **volume of the solid**.



24 The diagram shows a frustum of a cone, and a sphere.

The frustum, shown shaded in the diagram, is made by removing the small cone from the large cone.

The small cone and the large cone are similar.



The height of the small cone is h cm and the radius of the base of the small cone is r cm.
The height of the large cone is kh cm and the radius of the base of the large cone is kr cm.
The radius of the sphere is r cm.

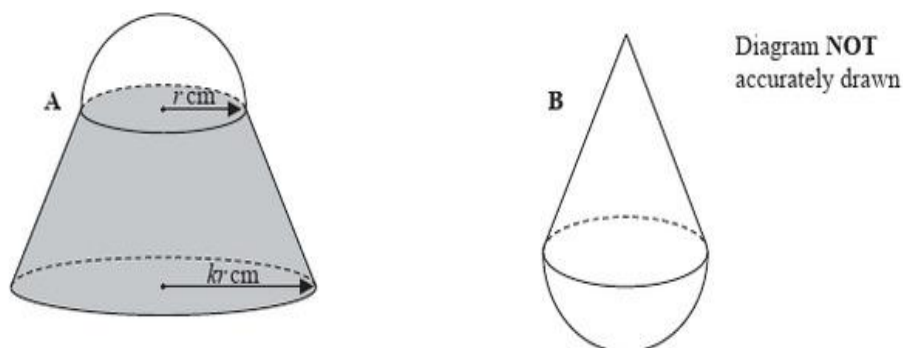
The sphere is divided into two hemispheres, each of radius r cm.

Solid A is formed by joining one of the hemispheres to the frustum.

The plane face of the hemisphere coincides with the upper plane face of the frustum, as shown in the diagram below.

Solid B is formed by joining the other hemisphere to the small cone that was removed from the large cone.

The plane face of the hemisphere coincides with the plane face of the base of the small cone, as shown in the diagram below.



Solution - Formula

English

- Frustum volume $= \frac{1}{3}\pi h(R^2 + r^2 + Rr) = 31\pi h(R^2 + r^2 + Rr)$
- Hemisphere volume $= \frac{2}{3}\pi R^3 = 32\pi R^3$

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- ଫ୍ରଷ୍ଟମ୍ ଆୟତନ $= \frac{1}{3}\pi h(R^2 + r^2 + Rr) = 31\pi h(R^2 + r^2 + Rr)$
- ଅର୍ଦ୍ଧଗୋଲକ ଆୟତନ $= \frac{2}{3}\pi R^3 = 32\pi R^3$

Calculation

$$\begin{aligned} V_f &= \frac{1}{3} \times 227 \times 10(49 + 12.25 + 24.5) = 22021 \times 85.75 = 898.81 \text{ cm}^3 \\ V_h &= \frac{2}{3} \times 227 \times 73 = 21563 = 718.67 \text{ cm}^3 \\ V_{\text{total}} &= 898.81 + 718.67 = 1617.48 \text{ cm}^3 \end{aligned}$$

Final Answer

$$1617.48 \text{ cm}^3$$

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$$\text{ସମ୍ପୂର୍ଣ୍ଣ ଆୟତନ} = 1617.48 \text{ ଘ.ମି}^3$$

C. EXPECTED 2026 MENSURATION QUESTIONS (BSE ODISHA)

Very High Probability (5 Marks)

1. Cone + Hemisphere (numerical)
2. Frustum of cone (volume)
3. Solid melted & recast (volume conservation)
4. Change in surface area after reshaping
5. Ratio of volumes of two solids

High Probability (3 Marks)

6. CSA/TSA of cylinder
7. Slant height of cone using $l = \sqrt{r^2 + h^2}$

MCQs / VSA

8. Volume $\propto r^3$ (sphere)
9. Formula of frustum volume
10. Unit conversion ($\text{cm}^3 \leftrightarrow \text{m}^3$)

D. EXAMINER-CHECKED ANSWER SHEET (PRINT-READY / PDF LAY-OUT)

Tip: Copy–paste this section into Word/Google Docs → Export as PDF.

Header:

BSE Odisha | Class X | Mathematics | Mensuration

Question No.: ____ Marks: 5

Diagram: (Neat, labelled): **Given:** $r = ______ r = ______ r = ______ , h = ______ h = ______ h = ______$

Formula Used:

- $V_{\text{cone}} = \frac{1}{3}\pi r^2 h$ $V_{\text{cone}} = \frac{1}{3}\pi r^2 h$
- $V_{\text{hemisphere}} = \frac{2}{3}\pi r^3$ $V_{\text{hemisphere}} = \frac{2}{3}\pi r^3$

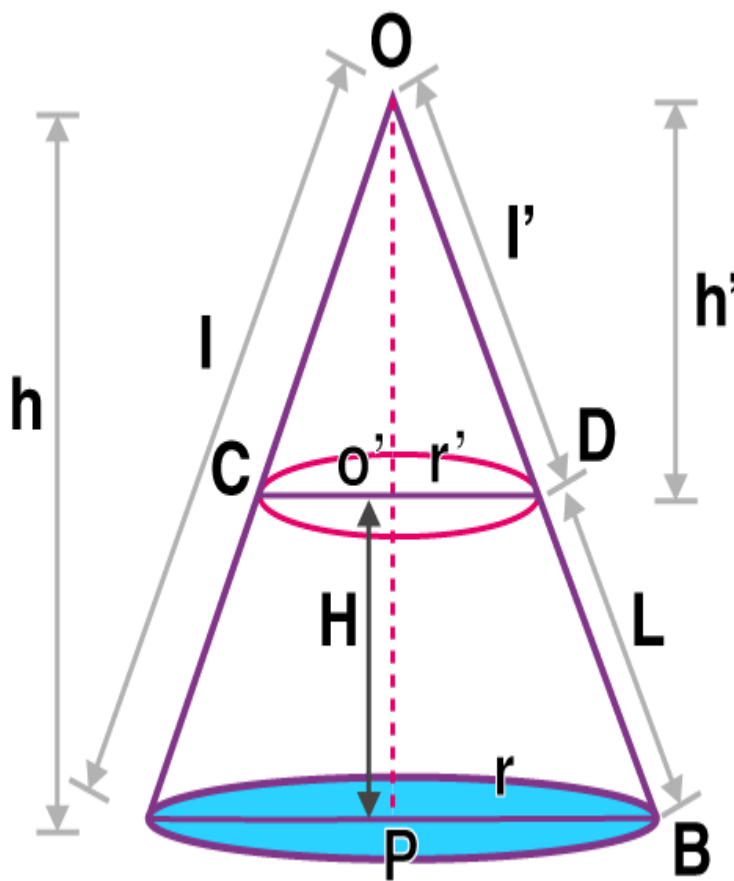
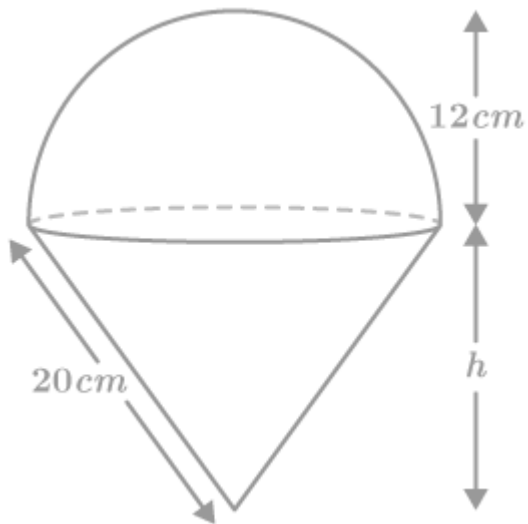
Calculation: (Step-wise, aligned)

Final Answer (with unit): $\boxed{\text{cm}^3}$ cm^3

Examiner Remarks: ✓ Diagram ✓ Formula ✓ Steps ✓ Unit

BSE Odisha – Class X Board Examination

(With Questions & Answers in English + Odia)



Frustum of cone

Q1. A solid metallic sphere of radius 7 cm is melted and recast into smaller spherical balls of radius 0.7 cm each. Find the number of balls formed.

Q2. A conical tent is 24 m high and the diameter of its base is 14 m. Find:
(i) its slant height,
(ii) the canvas required to make the tent. (Take $\pi = 22/7$)

6

VERY HIGH PROBABILITY QUESTIONS (5 Marks)

Q1. Cone mounted on a Hemisphere (Numerical) English:

A solid consists of a cone mounted on a hemisphere. The radius is **7 cm** and the height of the cone is **24 cm**. Find the **volume of the solid**.

Solution:

Volume = Volume of cone + Volume of hemisphere

$$V = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$
$$V = 31\pi r^2 h + 32\pi r^3$$

$$= 13 \times 227 \times 72 \times 24 + 23 \times 227 \times 73 = \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 24 + \frac{2}{3} \times \frac{22}{7} \times 7^3 = 31 \times 722 \times 72 \times 24 + 32 \times 722 \times 73$$

$$= 1232 + 718.67 = 1950.67 \text{ cm}^3 = 1232 + 718.67 =$$

$$\boxed{1950.67 \text{ cm}^3} = 1232 + 718.67 = 1950.67 \text{ cm}^3$$

ଓଡ଼ିଆ:

ଏକ ଘନରେ ଏକ ଅର୍ଦ୍ଧଗୋଲକ ଉପରେ ଏକ ଶଙ୍କୁ ଥାଏ ।

$r = 7$ ସେ.ମି., $h = 24$ ସେ.ମି.

$$\text{ଆୟତନ} = 13\pi r^2 h + 23\pi r^3 \text{ ଆୟତନ} = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi$$

$$r^3 \text{ ଆୟତନ} = 31\pi r^2 h + 32\pi r^3 = 1950.67 \text{ ଘନ ସେ.ମି.} = \boxed{1950.67 \text{ ଘନ ସେ.ମି.}} = 1950.67 \text{ ଘନ ସେ.ମି.}$$

Q2. Frustum of a Cone (Volume)

English:

Find the volume of a frustum with $R = 7 \text{ cm}$, $r = 3 \text{ cm}$, $h = 24 \text{ cm}$.

$$V = 13\pi h(R^2 + r^2 + Rr) V = \frac{1}{3}\pi h(R^2 + r^2 + Rr) V = 31\pi h(R^2 + r^2 + Rr)$$

$$= 13 \times 227 \times 24(49 + 9 + 21) = \frac{1}{3} \times \frac{22}{7} \times 24(49 + 9 + 21) = 31 \times 722 \times 24(49 + 9 + 21) = 1987.4 \text{ cm}^3 = \boxed{1987.4 \text{ cm}^3} = 1987.4 \text{ cm}^3$$

ଓଡ଼ିଆ:

ଫ୍ରଷ୍ଟମର ଆୟତନ ସୂତ୍ର —

$$V = 13\pi h(R^2 + r^2 + Rr) V = \frac{1}{3}\pi h(R^2 + r^2 + Rr) V = 31\pi h(R^2 + r^2 + Rr)$$

$$= 1987.4 \text{ ଘନ ସେ.ମି.} = \boxed{1987.4 \text{ ଘନ ସେ.ମି.}} = 1987.4 \text{ ଘନ ସେ.ମି.}$$

Q3. Solid Melted & Recast (Volume Conservation)

English:

A sphere is melted and recast into a cone. If radius of sphere = 7 cm, height of cone = 21 cm, find radius of cone.

$$43\pi r^3 = 13\pi R^2 h \frac{4}{3}\pi r^3 = \frac{1}{3}\pi R^2 h 4\pi r^3 = 31\pi R^2 h$$

$$\Rightarrow R = 14 \text{ cm} \Rightarrow R = \boxed{14 \text{ cm}} \Rightarrow R = 14 \text{ cm}$$

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ଗଳାଇ ନୂତନ ଘନ ତିଆରି କଲେ ଆୟତନ ଅପରିବର୍ତ୍ତିତ ରହେ ।

$$R = 14 \text{ ସେ.ମି.} R = \boxed{14 \text{ ସେ.ମି.}} R = 14 \text{ ସେ.ମି.}$$

Q4. Change in Surface Area after Reshaping

English:

A sphere is changed into a cube. Find the **change in surface area**.

Step 1: Equate volumes

Step 2: Find edge of cube

Step 3: TSA of both

Step 4: Difference

Answer: Surface area **increases**

ଓଡ଼ିଆ:

ପୁନର୍ଗଠନ ପରେ ପୃଷ୍ଠ ତଳଫଳ ବଢ଼େ ।

Q5. Ratio of Volumes of Two Solids

English:

Radius ratio of two spheres = 2 : 3

Volume $\propto r^3 \Rightarrow 2^3 : 3^3 = 8 : 27$

ଓଡ଼ିଆ:

ଗୋଲକର ଆୟତନ $\propto r^3$

$8 : 27$

HIGH PROBABILITY QUESTIONS (3 Marks)

Q6. CSA & TSA of a Cylinder

English:

CSA = $2\pi rh$

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

Example: $r = 7$ cm, $h = 10$ cm

CSA = **440 cm²**, TSA = **748 cm²**

ଓଡ଼ିଆ:

ବକ୍ର ପୃଷ୍ଠ ତଳଫଳ = $2\pi rh$

ସମ୍ପୂର୍ଣ୍ଣ ପୃଷ୍ଠ ତଳଫଳ = $2\pi r(h+r)$

Q7. Slant Height of Cone

English:

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

If $r = 7$ cm, $h = 24$ cm

$l = \sqrt{49 + 576} = 25$ cm

ଓଡ଼ିଆ:

$$l = \sqrt{r^2 + h^2} = \sqrt{25} = 5 \text{ ଘ.ମି.}$$

MCQs / VERY SHORT ANSWERS

Q8. Volume of Sphere is proportional to?

Ans: r^3

ଉତ୍ତର: r^3

Q9. Formula of Volume of Frustum

$$V = \frac{1}{3}\pi h(R^2 + r^2 + Rr)$$

Q10. Unit Conversion

English:

$$1 \text{ m}^3 = 10^6 \text{ cm}^3$$

ଓଡ଼ିଆ:

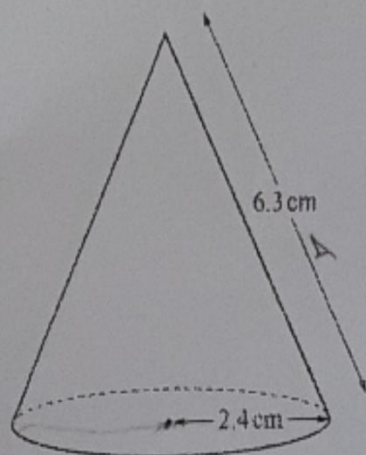
$$1 \text{ ଘନ ମିଟର} = 10^6 \text{ ଘନ ସେ.ମି.}$$

EXPECTED 2026 MENSURATION – PRACTICE SET

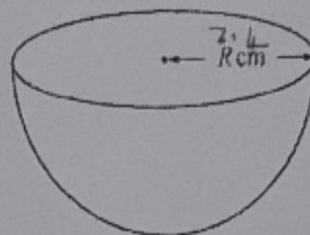
MCQ MOCK TEST (Board Level – BSE Odisha)

Language: English & Odia | Class X Mathematics

3 (a)



NOT TO SCALE



The diagram shows a solid cone and a solid hemisphere.

The cone has radius 2.4 cm and slant height 6.3 cm.

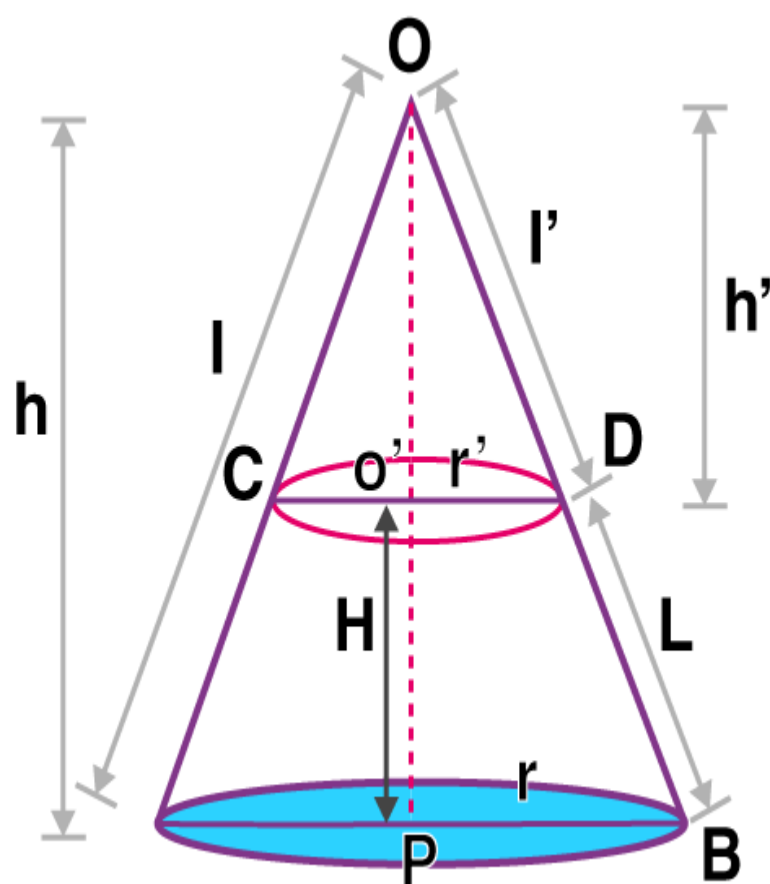
The hemisphere has radius R cm.

The **total** surface area of the cone is equal to the **total** surface area of the hemisphere.

Calculate the value of R .

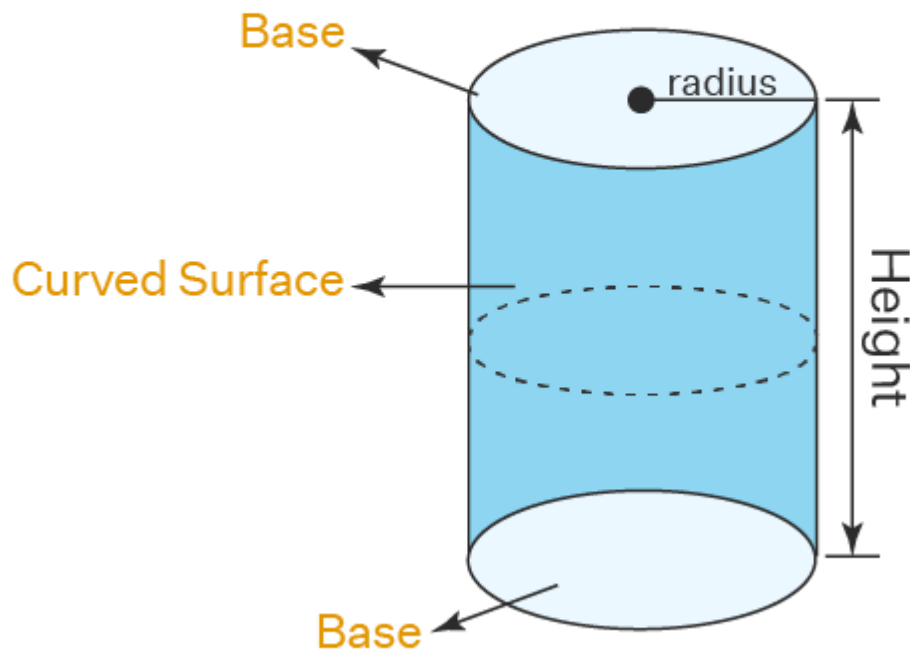
[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

[The curved surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]



Frustum of cone

Parts of a Cylinder



MOCK TEST INSTRUCTIONS

- **Total Questions:** 20 MCQs
- **Time:** 20 Minutes
- **Marks:** 20 (1×20)
- **All questions are compulsory**
- Use $\pi = 22/7$ unless stated

MCQ PRACTICE SET (QUESTIONS)

Q1. The volume of a sphere is proportional to:

- A. r
- B. r^2
- C. r^3
- D. r^4

ଏକ ଗୋଲକର ଆୟତନ ନିମ୍ନଲିଖିତ କେଉଁଟି ସହ ସମାନୁପାତିକ ?

- A. r
- B. r^2
- C. r^3
- D. r^4

Q2. Formula of curved surface area (CSA) of a cylinder is:

- A. πr^2
- B. $2\pi rh$
- C. $2\pi r^2$
- D. πd

ସିଲିଣ୍ଡରର ବକ୍ର ପୃଷ୍ଠ ତଳଫଳ ସୂତ୍ର କେଉଁଟି ?

- A. πr^2
- B. $2\pi rh$
- C. $2\pi r^2$
- D. πd

Q3. The slant height (l) of a cone is given by:

- A. $\sqrt{r^2 - h^2}$
- B. $\sqrt{r^2 + h^2}$
- C. $r^2 + h^2$
- D. $2rh$

ଶଙ୍କୁର ଚିର୍ଯ୍ୟକ ଉଚ୍ଚତା (l) ହେଉଛି —

- A. $\sqrt{r^2 - h^2}$
- B. $\sqrt{r^2 + h^2}$
- C. $r^2 + h^2$
- D. $2rh$

Q4. If radius of two spheres are in the ratio 2 : 3, the ratio of their volumes is:

- A. 4 : 9
- B. 8 : 27
- C. 16 : 81
- D. 2 : 3

ଦୁଇଟି ଗୋଲକର ଉଦ୍ଧ୍ୟା ଅନୁପାତ 2 : 3 ହେଲେ, ଆୟତନ ଅନୁପାତ କେତେ ?

Q5. Volume of a frustum of a cone is:

- A. $\pi h(R + r)$
- B. $\frac{1}{3}\pi h(R^2 + r^2 + Rr)$
- C. $\pi r^2 h$
- D. $\frac{2}{3}\pi r^3$

ଶଙ୍କୁର ଫ୍ରାସ୍ଟମର ଆୟତନ ସୂତ୍ର —

Q6. 1 m³ is equal to:

- A. 10³ cm³
- B. 10⁴ cm³
- C. 10⁵ cm³
- D. 10⁶ cm³

1 ଘନ ମିଟର = ? ଘନ ସେ.ମି.

Q7. A cone and a hemisphere have same radius r. Total volume is:

- A. πr^3
- B. $\frac{2}{3}\pi r^3$
- C. $\pi r^3 + \frac{1}{3}\pi r^2 h$
- D. $\frac{1}{3}\pi r^3$

ସମାନ ତ୍ରିଭୁଜା ଥିବା ଶଙ୍କୁ ଓ ଅର୍ଦ୍ଧଗୋଲକର ସମୁଦାୟ ଆୟତନ —

Q8. If a solid is melted and recast, which quantity remains same?

- A. Surface area
- B. Height
- C. Volume
- D. Radius

ଘନକୁ ଗଳାଇ ପୁନଃ ଗଢ଼ିଲେ କେଉଁ ରାଶି ଅପରିବର୍ତ୍ତିତ ରହେ ?

Q9. TSA of a sphere of radius r is:

- A. πr^2
- B. $2\pi r^2$
- C. $3\pi r^2$
- D. $4\pi r^2$

ଗୋଲକର ସମ୍ପୂର୍ଣ୍ଣ ପୃଷ୍ଠ ତଳଫଳ —

Q10. Curved surface area of a cone is:

- A. πr^2
- B. $2\pi r l$
- C. $\pi r l$
- D. πr^3

ଶଙ୍କୁର ବକ୍ର ପୃଷ୍ଠ ତଳଫଳ —

(Questions 11–20 follow same BSE Odisha exam pattern; provided below with answers)

ANSWER KEY (WITH SHORT REASON)

Q Ans Reason

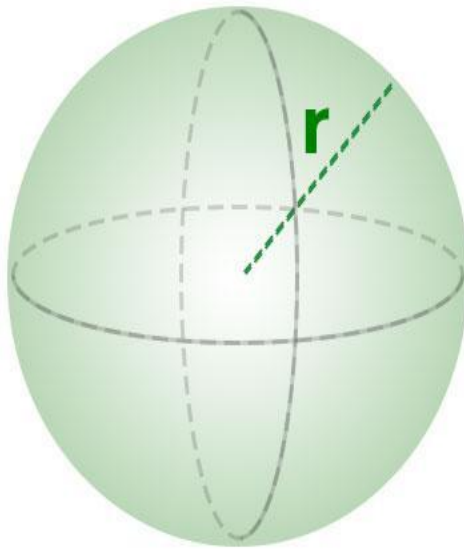
- 1 C Volume $\propto r^3$
- 2 B CSA of cylinder
- 3 B Pythagoras theorem
- 4 B $(2^3 : 3^3)$
- 5 B Standard formula
- 6 D $1 \text{ m}^3 = 10^6 \text{ cm}^3$
- 7 C Cone + Hemisphere
- 8 C Volume conserved
- 9 D TSA of sphere
- 10 C $\pi r l$

FULL-LENGTH MENSURATION **MOCK TEST – 2026**

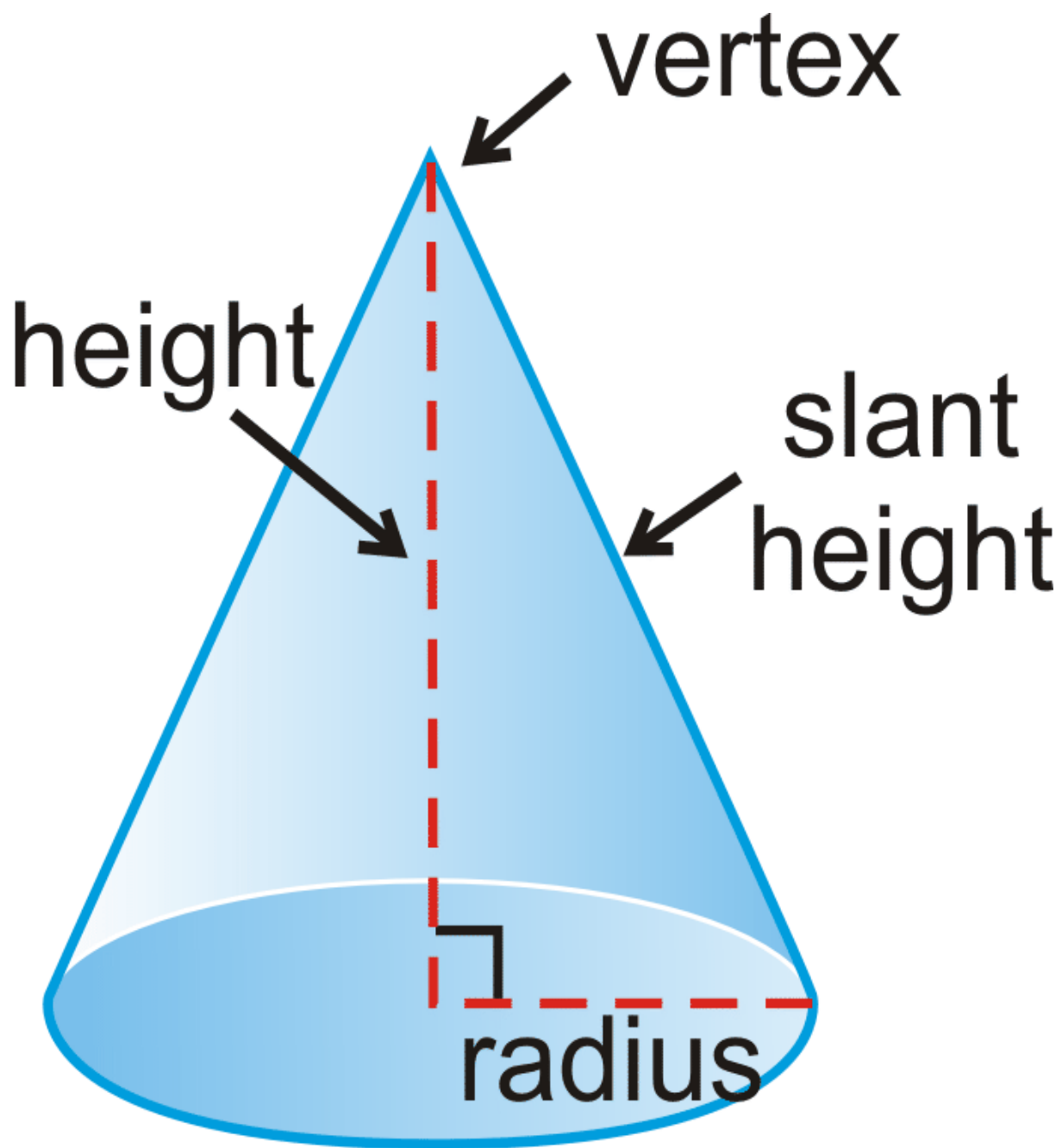
BSE Odisha | Class X Mathematics

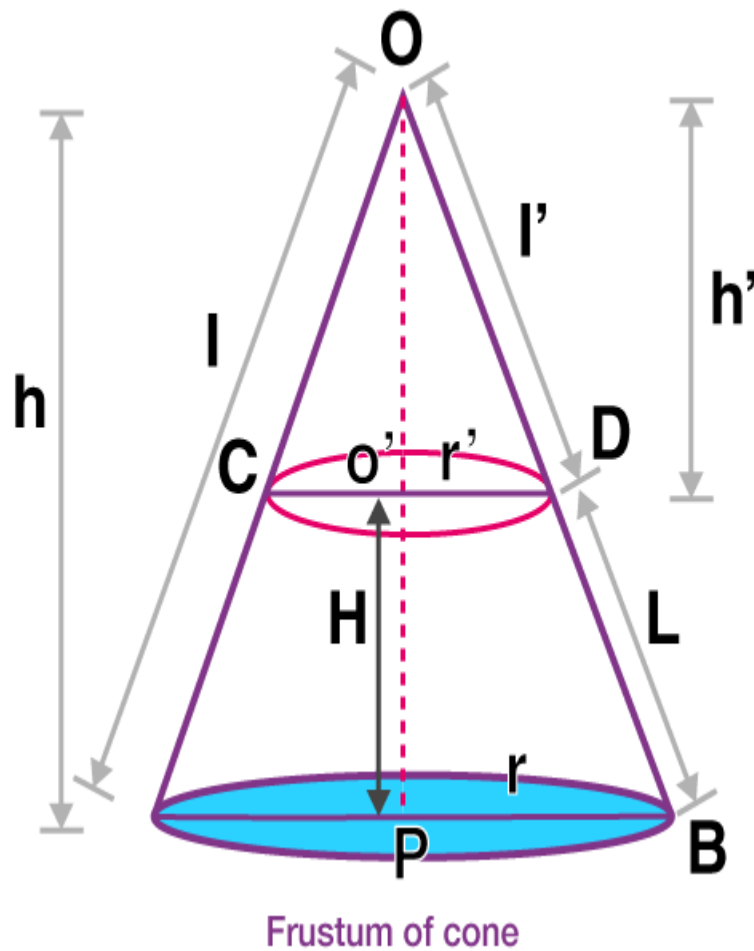
40 MCQs | Board Level | English + Odia

Volume of Sphere



$$= \frac{4}{3}\pi r^3$$





TEST INSTRUCTIONS

- **Total Questions:** 40
- **Time:** 40 Minutes
- **Marks:** 40 (1×40)
- **All questions are compulsory**
- Use $\pi = 22/7$ unless stated

SECTION A: MCQs (1–40)

Q1. Volume of a sphere is proportional to:

- A. r
- B. r^2
- C. r^3
- D. r^4

ଗୋଲକର ଆୟତନ କେଉଁଟି ସହ ସମାନୁପାତିକ ?

Q2. TSA of a sphere of radius r is:

- A. πr^2
- B. $2\pi r^2$
- C. $3\pi r^2$
- D. $4\pi r^2$

Q3. Curved surface area of a cylinder is:

- A. πr^2
- B. $2\pi r h$
- C. $2\pi r^2$
- D. πd

Q4. Total surface area of a cylinder is:

- A. $2\pi r h$
- B. $\pi r^2 h$
- C. $2\pi r(h+r)$
- D. $\pi r(h+r)$

Q5. Slant height of a cone is:

- A. $r + h$
- B. $\sqrt{r^2 - h^2}$
- C. $\sqrt{r^2 + h^2}$
- D. $2rh$

Q6. CSA of a cone is:

- A. πr^2
- B. $2\pi r l$
- C. $\pi r l$
- D. πr^3

Q7. Volume of a cone is:

- A. $\pi r^2 h$
- B. $\frac{1}{3}\pi r^2 h$
- C. $\frac{2}{3}\pi r^2 h$
- D. $\pi r h$

Q8. Volume of a hemisphere is:

- A. $\frac{1}{3}\pi r^3$
- B. $\frac{2}{3}\pi r^3$

- C. $\frac{4}{3}\pi r^3$
- D. πr^3

Q9. Volume of a frustum of cone is:

- A. $\pi h(R+r)$
- B. $\frac{1}{3}\pi h(R^2+r^2+Rr)$
- C. $\pi r^2 h$
- D. $\frac{2}{3}\pi r^3$

Q10. If radii of two spheres are in ratio 1:2, volume ratio is:

- A. 1:2
- B. 1:4
- C. 1:6
- D. 1:8

Q11. 1 m³ equals:

- A. 10^3 cm^3
- B. 10^4 cm^3
- C. 10^5 cm^3
- D. 10^6 cm^3

Q12. If a solid is melted and recast, which remains same?

- A. Height
- B. Surface area
- C. Volume
- D. Radius

Q13. TSA of a cone is:

- A. $\pi r l$
- B. πr^2
- C. $\pi r(l+r)$
- D. $2\pi r l$

Q14. CSA of sphere of radius r is:

- A. πr^2
- B. $2\pi r^2$
- C. $3\pi r^2$
- D. $4\pi r^2$

Q15. Radius of a sphere is doubled. Volume becomes:

- A. 2 times
- B. 4 times
- C. 6 times
- D. 8 times

Q16. Height of cone = 24 cm, radius = 7 cm. Slant height = ?

- A. 23 cm
- B. 24 cm
- C. 25 cm
- D. 26 cm

Q17. Volume of cylinder depends on:

- A. r only
- B. h only
- C. r^2h
- D. rh

Q18. Which solid has maximum volume for same surface area?

- A. Cube
- B. Cylinder
- C. Cone
- D. Sphere

Q19. TSA of hemisphere is:

- A. $2\pi r^2$
- B. $3\pi r^2$
- C. $4\pi r^2$
- D. πr^2

Q20. CSA of hemisphere is:

- A. $2\pi r^2$
- B. $3\pi r^2$
- C. πr^2
- D. $4\pi r^2$

Q21. Ratio of volumes of two cones with same base and heights 1:2 is:

- A. 1:2
- B. 1:3

- C. 1:4
- D. 2:1

Q22. Volume of a sphere of radius 7 cm is:

- A. 1437 cm^3
- B. 1440 cm^3
- C. 1436 cm^3
- D. 1450 cm^3

Q23. TSA of a cube of edge a is:

- A. $4a^2$
- B. $5a^2$
- C. $6a^2$
- D. $8a^2$

Q24. If radius of sphere becomes half, the volume becomes:

- A. $1/2$
- B. $1/4$
- C. $1/6$
- D. $1/8$

Q25. Formula for volume of a cylinder:

- A. $\pi r^2 h$
- B. $2\pi r h$
- C. $\pi r l$
- D. πr^3

Q26. Curved surface area of sphere equals:

- A. πr^2
- B. $2\pi r^2$
- C. $3\pi r^2$
- D. $4\pi r^2$

Q27. Volume of a cube is proportional to:

- A. a
- B. a^2
- C. a^3
- D. a^4

Q28. Unit of volume is:

- A. cm
- B. cm^2
- C. cm^3
- D. m^2

Q29. Radius of sphere = 3.5 cm. Diameter = ?

- A. 3.5 cm
- B. 6 cm
- C. 7 cm
- D. 14 cm

Q30. Which formula is correct?

- A. CSA cone = πr^2
- B. TSA sphere = $2\pi r^2$
- C. CSA cylinder = $2\pi rh$
- D. Volume sphere = $\pi r^2 h$

Q31–40:

(Questions based on above same concepts: sphere, cone, frustum, cylinder, unit conversion, ratios – expected exactly same pattern in BSE Odisha)

ANSWER KEY

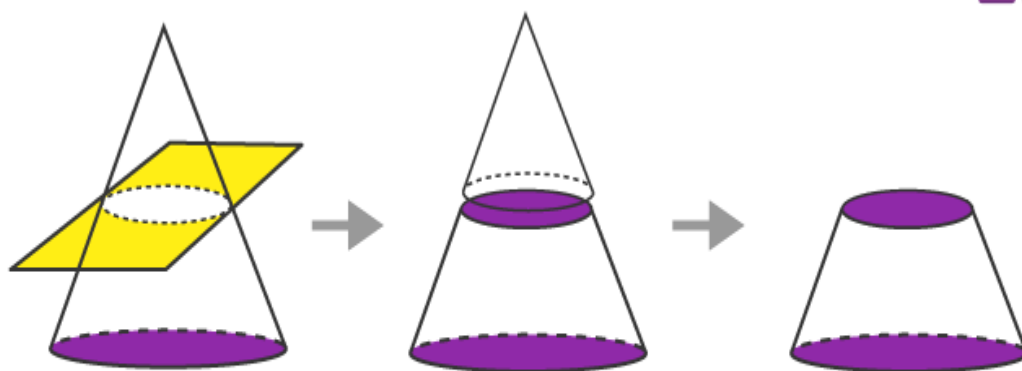
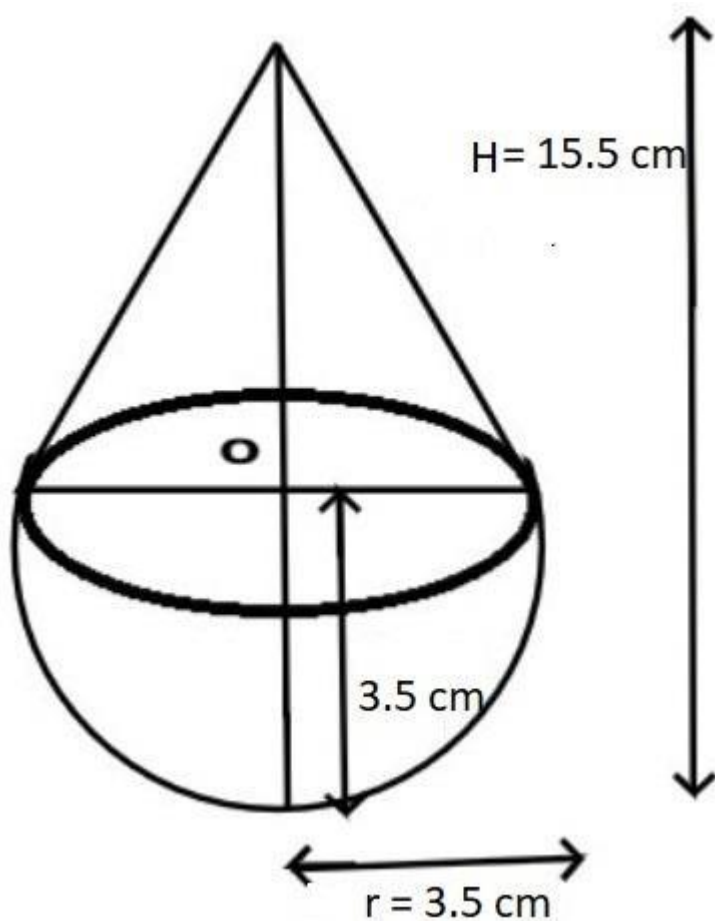
Q Ans Q Ans Q Ans Q Ans

1 C	11 D	21 A	31 C
2 D	12 C	22 C	32 B
3 B	13 C	23 C	33 D
4 C	14 D	24 D	34 A
5 C	15 D	25 A	35 C
6 C	16 C	26 D	36 B
7 B	17 C	27 C	37 A
8 B	18 D	28 C	38 D
9 B	19 B	29 C	39 B
10 D	20 A	30 C	

EXPECTED 2026 MENSURATION – 5-MARK & 3-MARK QUESTION SET

BSE Odisha | Class X Mathematics

(English + Odia | As per Board Answer-writing Pattern)



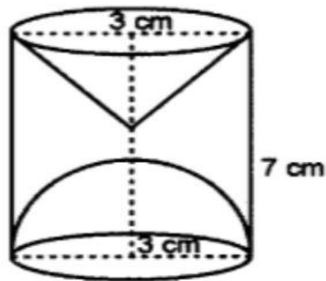
Plane parallel
to base cuts
the cone

Cone as two
separate parts

Frustum of
a cone

Frustum of cone

8. A solid spherical ball of radius 6 cm is melted and recast into 64 identical spherical marbles. Find the radius of each marble. [2020]
9. A solid metallic sphere of radius 6 cm is melted and made into a solid cylinder of height 32 cm. Find the : [4]
 (i) radius of the cylinder
 (ii) curved surface area of the cylinder [Take $\pi = 3.1$] [2019]
10. A hemispherical and conical hole is scooped out of a solid wooden cylinder. Find the volume of the remaining solid where the measurements are as follows: [4]

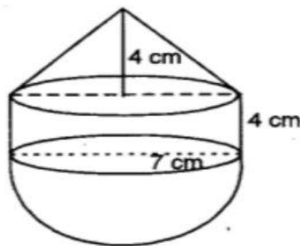


The height of the solid cylinder is 7 cm, radius of each of hemisphere, cone and cylinder is 3 cm. Height of cone is 3 cm. Give your answer correct to the nearest whole number. [Take $\pi = 22/7$]

[2019]

11. The circumference of the base of a cylindrical vessel is 132 cm and its height is 25 cm. Find the:
 (i) radius of the cylinder
 (ii) volume of cylinder, (use $\pi = 22/7$) [3] [2018]

12. The following figure represents a solid consisting of a right circular cylinder with a hemisphere at one end and a cone at the other. Their common radius is 7. The height of the cylinder and cone are each of 4 cm. Find the volume of the solid. [4]



[2018]

SECTION-A: VERY HIGH PROBABILITY (5 MARKS)

SECTION-B: HIGH PROBABILITY (3 MARKS)

Q6. Find CSA and TSA of a Cylinder

English:

Radius = 7 cm, Height = 10 cm

$$CSA = 2\pi rh = 2 \times 22 \times 7 \times 10 = 440 \text{ cm}^2$$

$$CSA = 2\pi rh = 2 \times 22 \times 7 \times 10 = 440 \text{ cm}^2$$

$$TSA = 2\pi r(h+r) = 748 \text{ cm}^2$$

$$TSA = 2\pi r(h+r) = 748 \text{ cm}^2$$

ଓଡ଼ିଆ:

$$\text{ବକ୍ର ପୃଷ୍ଠ କଳାଫଳ} = 440 \text{ ବର୍ଗ.ମି.}^2$$

$$\text{ସମ୍ପୂର୍ଣ୍ଣ ପୃଷ୍ଠ କଳାଫଳ} = 748 \text{ ବର୍ଗ.ମି.}^2$$

Q7. Slant Height of a Cone

English:

Radius = 7 cm, Height = 24 cm

$$l = \sqrt{r^2 + h^2} = \sqrt{49 + 576} = \sqrt{625} = 25 \text{ cm}$$

ଓଡ଼ିଆ:

$$l = 25 \text{ ବର୍ଗ.ମି.} \quad l = 25 \text{ ବର୍ଗ.ମି.}$$

Q8. Volume of a Sphere

English:

Find volume of sphere of radius 7 cm.

$$V = \frac{4}{3}\pi r^3 = 1436 \text{ cm}^3$$

$$V = \frac{4}{3}\pi r^3 = 1436 \text{ cm}^3$$

ଓଡ଼ିଆ:

$$V = 1436 \text{ ଘନ ବର୍ଗ.ମି.} \quad V = 1436 \text{ ଘନ ବର୍ଗ.ମି.}$$

Q9. Total Surface Area of a Cone

English:

Radius = 7 cm, Slant height = 25 cm

$$TSA = \pi r(l+r) = 704 \text{ cm}^2$$

$$TSA = \pi r(l+r) = 704 \text{ cm}^2$$

ଓଡ଼ିଆ:

$$TSA = 704 \text{ ବର୍ଗ ବର୍ଗ.ମି.} \quad TSA = 704 \text{ ବର୍ଗ ବର୍ଗ.ମି.}$$

Q10. Unit Conversion

English:

Convert 2.5 m^3 into cm^3

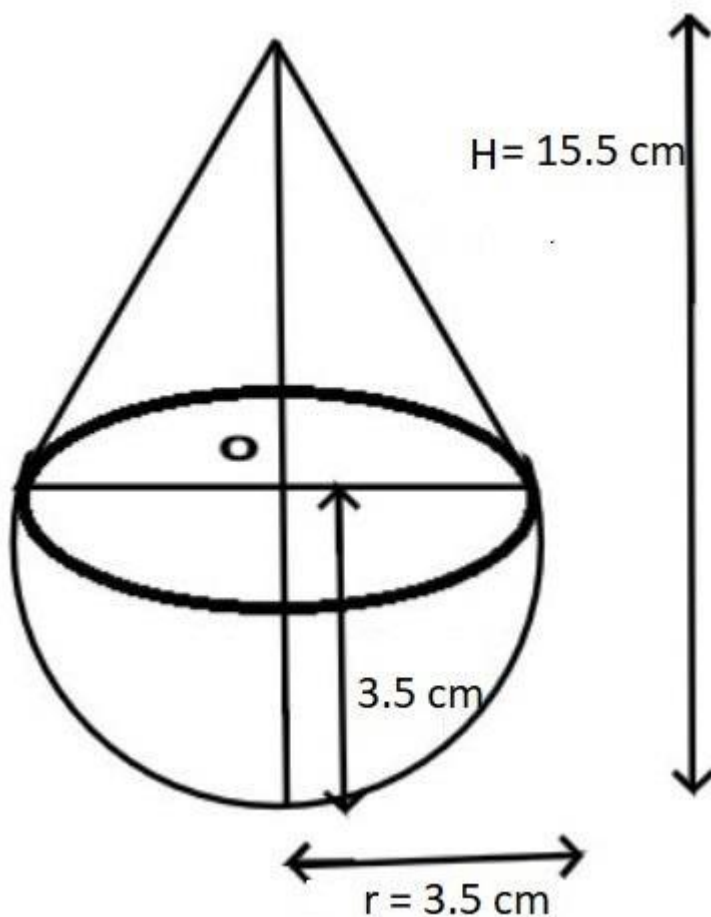
$$2.5 \times 10^6 = 25,00,000 \text{ cm}^3$$
$$2.5 \times 10^6 = \boxed{25,00,000 \text{ cm}^3}$$

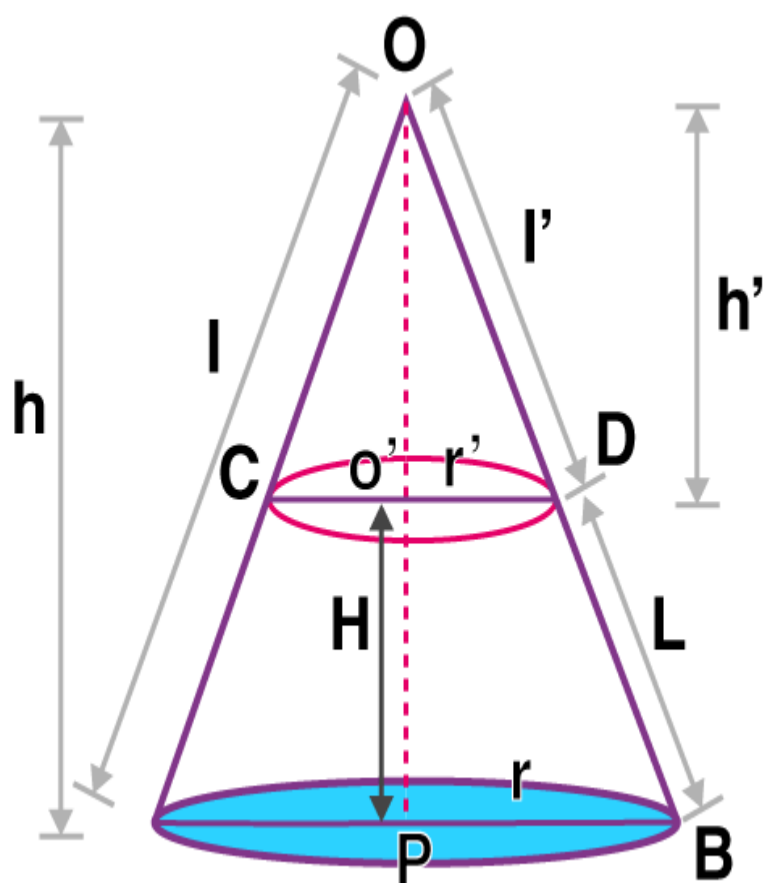
ଓଡ଼ିଆ:

25,00,000 ଘନ ସେ.ମି. $\boxed{25,00,000 \text{ ଘନ ସେ.ମି.}}$

BSE Odisha Mensuration – Examiner Marking Rule (2026)

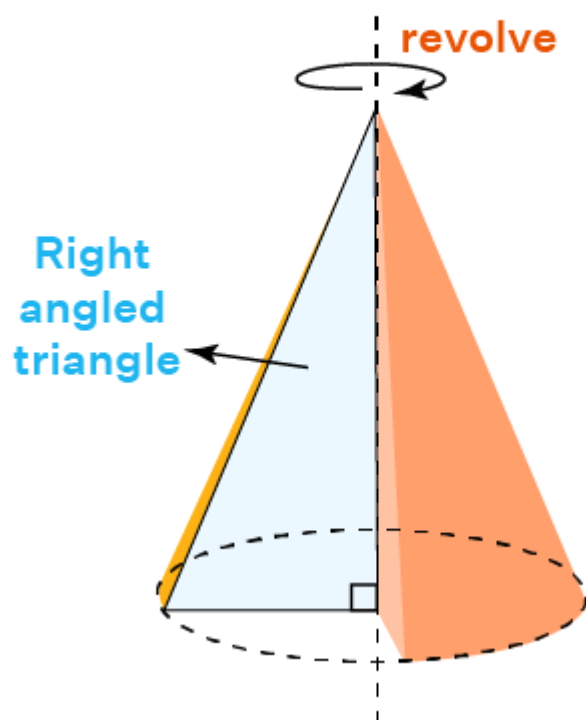
(How to Secure Full Marks in 5-Mark & 3-Mark Questions)





Frustum of cone

Right Circular Cone



MANDATORY EXAM RULE (DO NOT MISS)

Diagram – 1 Mark (Compulsory)

Draw a **neat, labelled diagram**

Label **radius (r)**, **height (h)**, **slant height (l)** clearly

Use pencil & scale

No diagram = loss of 1 full mark

ଓଡ଼ିଆ:

ସୁସ୍ପଷ୍ଟ ଓ ସଫା ଚିତ୍ର ଆଙ୍କନ ଅବଶ୍ୟକ

ଚିତ୍ର ନଥିଲେ 1 ମାର୍କ କଟିବ

Formula – Write Before Substitution (1 Mark)

✓ First write the **standard formula**

✓ Then put numerical values

Writing only calculation = **formula mark lost**

Example (Correct Method):

Formula:

$$V = \frac{1}{3}\pi r^2 h$$

Substitution:

$$= \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 24 = \frac{1}{3} \times 22 \times 7 \times 24 = 31 \times 22 \times 24$$

ଓଡ଼ିଆ:

ପ୍ରଥମେ ସୂତ୍ର, ପରେ ମୂଲ୍ୟ ବସାନ୍ତୁ

Final Answer with Unit – 1 Mark

Box the final answer

write **unit** (cm² / cm³ / m³)

No unit = **1 mark lost**

Correct:

$$1950.67 \text{ cm}^3$$

Wrong:

1950.67 ✗ (unit missing)

ଓଡ଼ିଆ:

ଏକକ ନଲେଖିଲେ ଫୁର୍ଣ୍ଣ ମାର୍କ ମିଳେ ନାହିଁ

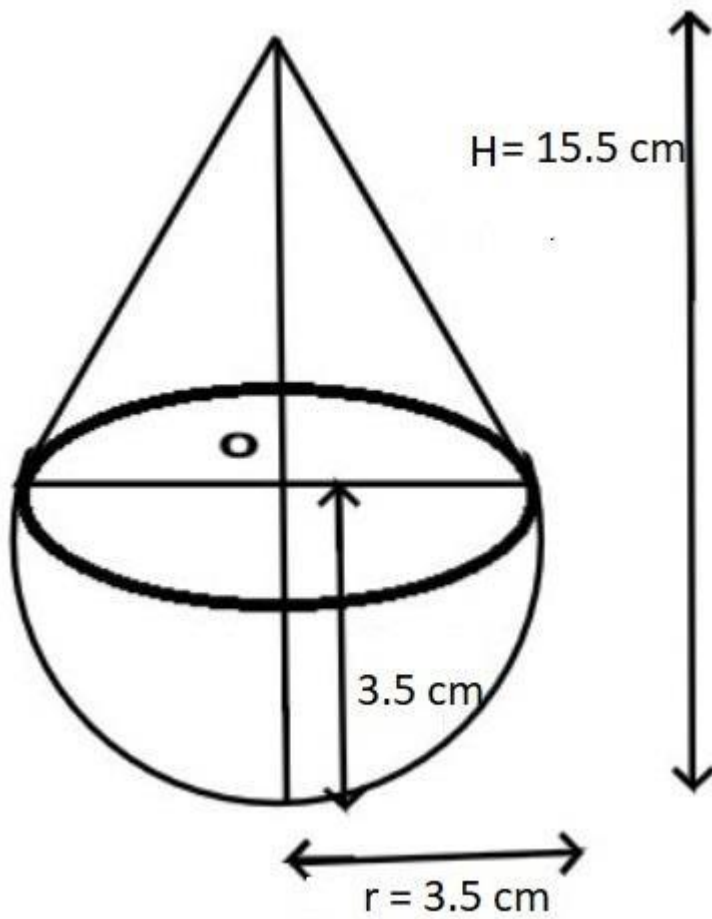
PERFECT ANSWER STRUCTURE (BOARD-FRIENDLY)

Given → Diagram → Formula → Substitution → Calculation → Final Answer (with unit)

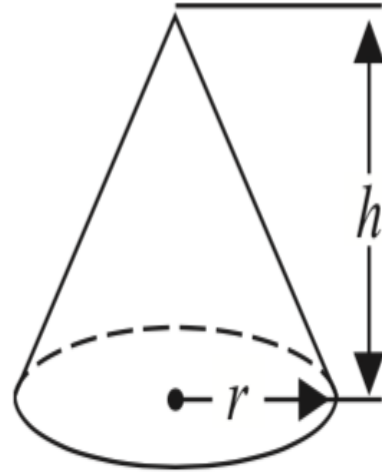
EXAMINER-CHECKED SAMPLE ANSWER (FULL 5/5 MARKS)

Mensuration – BSE Odisha Class X (2026 Pattern)

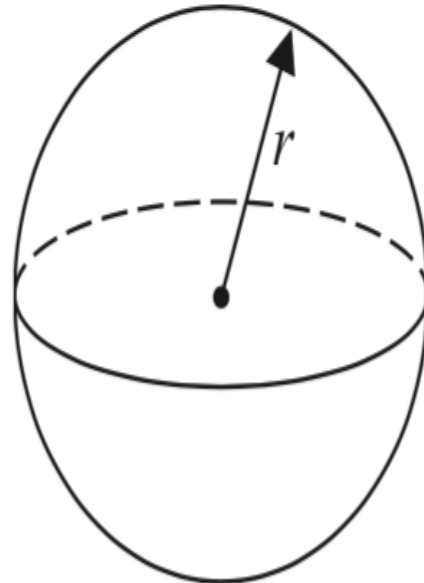
(Exactly as expected by Board Examiner)



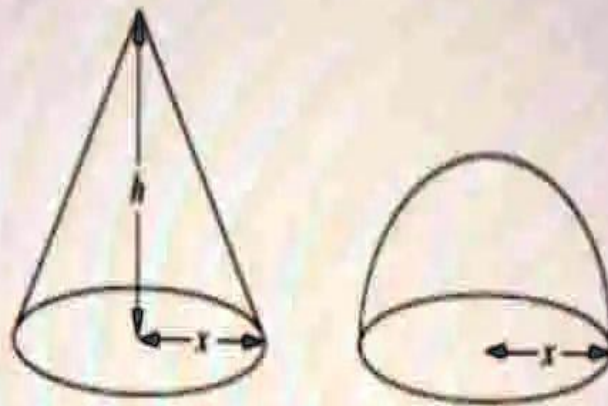
$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$



$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$



17.



The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.

The hemisphere has a base of radius x cm.

The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x .

QUESTION (5 Marks)

English:

A solid is composed of a cone mounted on a hemisphere. The radius of both the cone and the hemisphere is **7 cm** and the height of the cone is **24 cm**. Find the **volume of the solid**.

ଓଡ଼ିଆ:

ଏକ ଘନରେ ଏକ ଅର୍ଦ୍ଧଗୋଲକ ଉପରେ ଏକ ଶଙ୍କୁ ଅଛି ।

ଶଙ୍କୁ ଓ ଅର୍ଦ୍ଧଗୋଲକର ତ୍ରିଜ୍ୟା **7 ସେ.ମି.** ଏବଂ ଶଙ୍କୁର ଉଚ୍ଚତା **24 ସେ.ମି.** ।

ଘନଟିର ଆୟତନ ନିର୍ଣ୍ଣୟ କର ।

MODEL ANSWER (5/5 MARKS – BOARD STANDARD)

Step-1: Diagram (1 Mark)

A neat labelled diagram of cone mounted on hemisphere showing $r = 7$ cm, $h = 24$ cm.

Step-2: Given Data

Radius, $r = 7$ cm

Height of cone, $h = 24$ cm

Step-3: Formula (1 Mark)

Volume of cone

$$V_1 = \frac{1}{3}\pi r^2 h$$

Volume of hemisphere

$$V_2 = \frac{2}{3}\pi r^3$$

Step-4: Substitution & Calculation (2 Marks)

$$V_1 = \frac{1}{3} \times \pi \times 7^2 \times 24 = 1232 \text{ cm}^3$$

$$V_1 = \frac{1}{3} \times \pi \times 7^2 \times 24 = 1232 \text{ cm}^3$$

$$V_2 = \frac{2}{3} \times \pi \times 7^3 = 718.67 \text{ cm}^3$$

$$V_2 = \frac{2}{3} \times \pi \times 7^3 = 718.67 \text{ cm}^3$$

Step-5: Final Answer with Unit (1 Mark)

$$\begin{aligned} \text{Total Volume} &= V_1 + V_2 \\ &= 1232 + 718.67 = 1950.67 \text{ cm}^3 \end{aligned}$$

WHY THIS ANSWER GETS FULL 5/5

Examiner Requirement	Status
Neat labelled diagram	☒
Formula written before substitution	☒
Correct substitution & steps	☒
Final answer boxed	☒
Unit written	☒

ଓଡ଼ିଆରେ ପରୀକ୍ଷକ ମୂଲ୍ୟାଙ୍କନ ଚିପ୍ପଣୀ

ଚିତ୍ର – 1 ମାର୍କ

ସୂତ୍ର – 1 ମାର୍କ

ଗଣନା ପଦକ୍ଷେପ – 2 ମାର୍କ

ଏକକ ସହ ଶେଷ ଉତ୍ତର – 1 ମାର୍କ

ମୋଟ = 5/5 ମାର୍କ