

CLASS 9 · HOTS · OLYMPIAD PREPARATION · SHORT NOTES

Chapter 14: HOTS: Surface Area and Volume (Class 9)

Topic-wise short notes with solved examples

Higher order thinking questions on surface area and volume for Class 9: cuboids, cylinders, cones, spheres and hemispheres, melting and recasting and finding a missing dimension, each with a full solution.

1 Solved HOTS questions

- Formulas (take $\pi = \frac{22}{7}$): cuboid volume lbh , total surface area $2(lb + bh + hl)$; cylinder $\pi r^2 h$ and curved area $2\pi rh$; cone $\frac{1}{3}\pi r^2 h$ and curved area πrl with $l = \sqrt{r^2 + h^2}$; sphere $\frac{4}{3}\pi r^3$ and area $4\pi r^2$; hemisphere curved area $2\pi r^2$ and total area $3\pi r^2$. When a solid is melted and recast, the volume stays the same.

Example 1.1 A cone has base radius 7 cm and height 24 cm. Find its slant height, curved surface area and volume.

SOLUTION

$$l = \sqrt{7^2 + 24^2} = \sqrt{625} = 25 \text{ cm.}$$

$$\text{Curved surface area} = \frac{22}{7} \times 7 \times 25 = 550 \text{ square cm.}$$

$$\text{Volume} = \frac{1}{3} \times \frac{22}{7} \times 49 \times 24 = 1232 \text{ cubic cm.}$$

25 cm, 550 square cm and 1232 cubic cm

Example 1.2 A cuboid of dimensions 44 cm by 21 cm by 12 cm is melted and recast into a cylinder of radius 14 cm. Find the height of the cylinder.

SOLUTION

$$\text{Volume of the cuboid} = 44 \times 21 \times 12 = 11\,088 \text{ cubic cm.}$$

$$\text{Base area of the cylinder} = \frac{22}{7} \times 14 \times 14 = 616.$$

$$\text{Height} = \frac{11\,088}{616}.$$

18 cm

Example 1.3 The total surface area of a solid hemisphere is 462 square cm. Find its radius and volume.

SOLUTION

Total area = $3\pi r^2 = 462$, so $r^2 = \frac{462 \times 7}{3 \times 22} = 49$ and $r = 7$ cm.

Volume = $\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 343$.

Radius 7 cm and volume $718\frac{2}{3}$ cubic cm

Example 1.4 The radius of a sphere is doubled. By what factor do its surface area and volume change?

SOLUTION

Surface area $\propto r^2$, so it becomes $2^2 = 4$ times as large.

Volume $\propto r^3$, so it becomes $2^3 = 8$ times as large.

4 times and 8 times

Example 1.5 How many metres of cloth 2 m wide are needed to make a conical tent with base radius 7 m and height 24 m? Take $\pi = \frac{22}{7}$.

SOLUTION

Slant height = 25 m. Curved area = $\frac{22}{7} \times 7 \times 25 = 550$ square m.

Length of cloth = $\frac{550}{2}$.

275 m