

**CLASS – 10**

**MATHEMATICS**

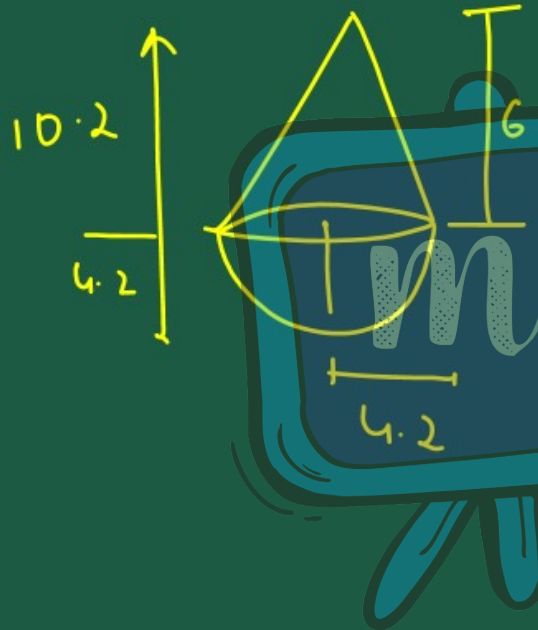
**CH – 12**

**SURFACE AREAS AND  
VOLUMES**

**CBSE Board**

**Most Important Questions – 1**

**Shubham Tiwari**

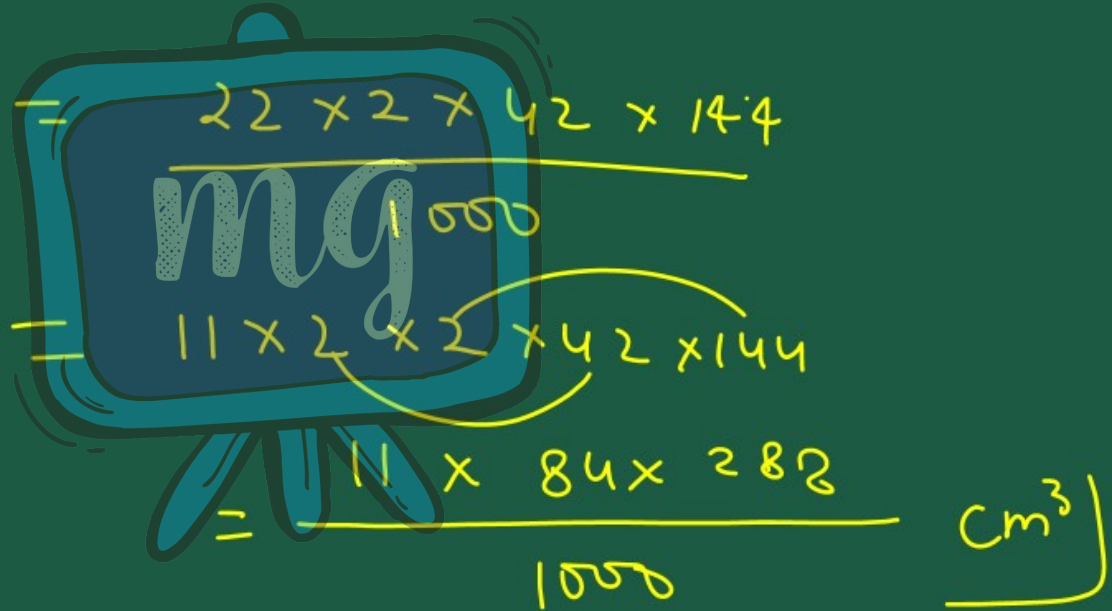
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1. A solid wooden toy is in the shape of a right circular cone mounted on a hemisphere. If the radius of the hemisphere is 4.2 cm and the total height of the toy is 10.2 cm, find the volume of the wooden toy.

Volume of the toy:-

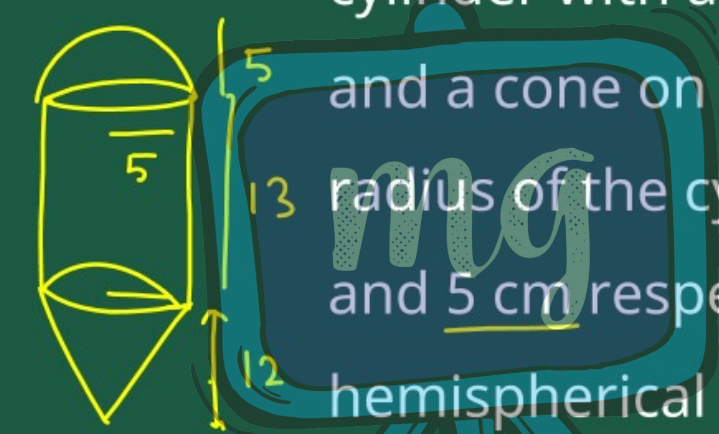
Volume of hemisphere + volume of cone

$$\begin{aligned} &= \frac{2}{3} \pi r^3 + \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \pi r^2 [2r + h] \\ &= \frac{1}{3} \times \frac{22}{7} \times 4.2 \times 4.2 [2 \times 4.2 + 6] \\ &= \frac{1}{3} \times \frac{22}{7} \times 4.2 \times 4.2 \times 16.4 \quad \left( \begin{array}{l} 8.4 + 6 \\ 14.4 \end{array} \right) \end{aligned}$$

$$= \frac{1}{3} \times \frac{22}{7} \times \frac{42^2}{10} \times \frac{42}{10} \times \frac{144}{10}$$


$$= \frac{22 \times 2 \times 42 \times 144}{1000}$$
$$= \frac{11 \times 2 \times 2 \times 42 \times 144}{1000}$$
$$= \frac{11 \times 84 \times 282}{1000} \text{ cm}^3$$

2. A toy is in the shape of a right circular cylinder with a hemisphere on one end and a cone on the other. The height and radius of the cylindrical part are 13 cm and 5 cm respectively. The radii of the hemispherical and conical parts are the same as that of the cylindrical part.



$$\begin{aligned}
 l^2 &= h^2 + r^2 \\
 &= 12^2 + 5^2 \\
 &= 144 + 25 \\
 l^2 &= 169 \\
 l &= \sqrt{169} = 13
 \end{aligned}$$

Calculate the surface area of the toy if height of the conical part is 12 cm.

CSA of cone + CSA of cylinder  
+ CSA of hemisphere.

$$= \pi r l + 2\pi r h + 2\pi r^2$$

$$= \pi r [l + 2h + 2r]$$

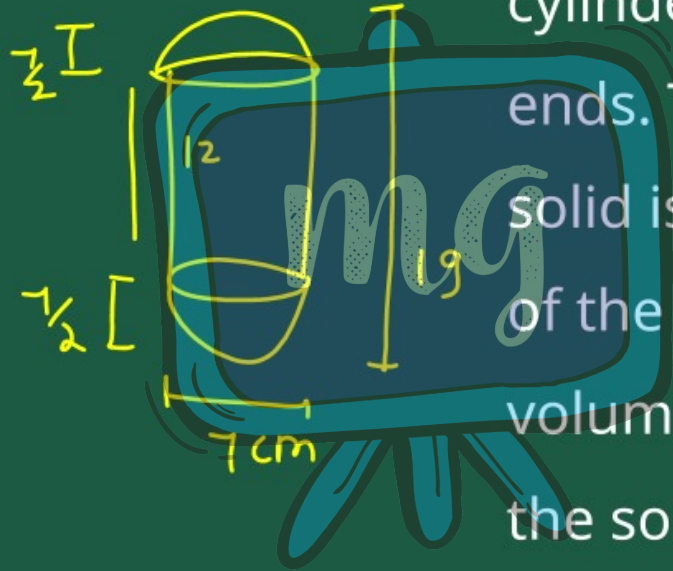
$$= \frac{22}{7} \times 5 [13 + 2 \times 13 + 10]$$

(13 + 26 + 10)

$$= \frac{22}{7} \times 5 \times 49$$

$$22 \times 35$$
$$11 \times 2 \times 35 = 770 \text{ cm}^2$$

3. A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 19 cm and the diameter of the cylinder is 7 cm. Find the volume and total surface area of the solid (Use  $\pi = 22/7$ )



Volem :- Volem of cylinder.

+ 2 x Volume of hemisphere.

$$= \pi r^2 h + 2 \times \frac{2}{3} \times \pi r^3$$

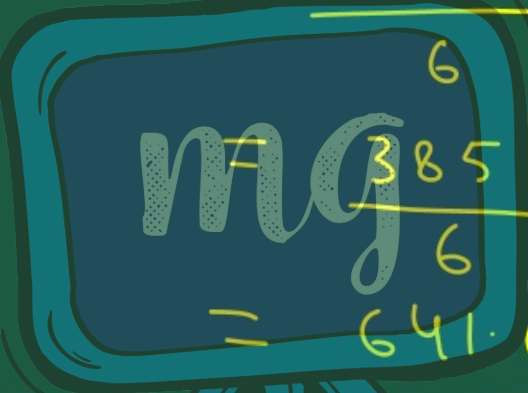
$$= \pi r^2 \left[ h + 2 \times \frac{2}{3} r \right]$$

$$= \frac{22}{7} \times \frac{1}{2} \times \frac{7}{2} \left[ 12 + \frac{4^2}{3} \times \frac{7}{2} \right]$$

$$= 11 \times \frac{7}{2} \left[ 12 + \frac{14}{3} \right]$$

$$= 11 \times \frac{7}{2} \times \frac{50}{3}$$

$$= \frac{11 \times 350}{6}$$



$$\begin{array}{r} 6 \\ 6 \overline{) 3850} \\ \underline{36} \phantom{0} \\ 25 \phantom{0} \\ \underline{24} \phantom{0} \\ 10 \phantom{0} \\ \underline{6} \phantom{0} \\ 40 \\ \underline{36} \\ 40 \\ \underline{36} \\ 40 \end{array}$$

$$\begin{array}{r} 35 \\ 3 \overline{) 385} \\ \underline{3} \phantom{0} \\ 8 \phantom{0} \\ \underline{6} \phantom{0} \\ 25 \\ \underline{21} \\ 40 \\ \underline{36} \\ 40 \end{array}$$

$$= 641.6 \text{ (m}^3\text{)}$$

SA of solid: - CSA of cylinder +  
2 x CSA of hemisphere

$$= 2\pi r h + 2 \times 2\pi r^2$$

$$= 2\pi r [h + 2r]$$



$$= 2 \times 22 \times \frac{7}{2} \left[ 12 + 2 \times \frac{7}{2} \right]$$

$$= 22 \times [12 + 7]$$

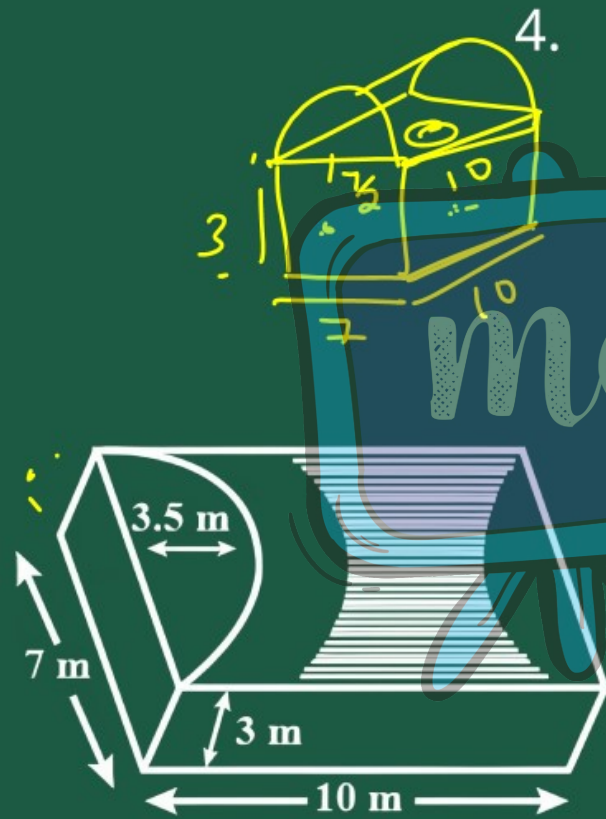
$$= 22 \times 19$$

$$= 2 \times 11 \times 19$$

$$= 38 \times 11$$

$$= \underline{418 \text{ cm}^2}$$

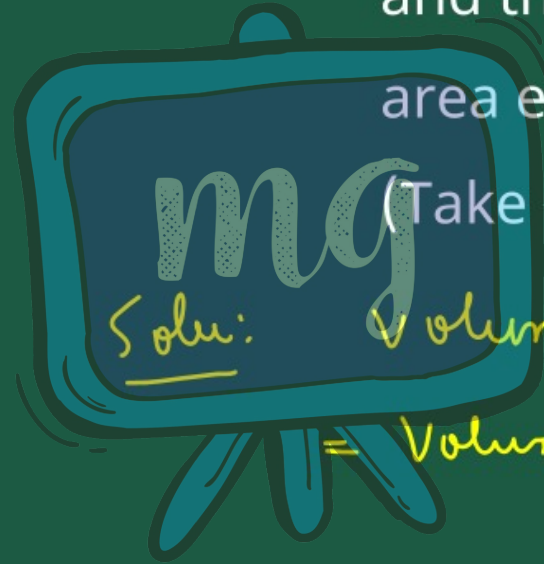
$$\begin{array}{r} 38 \times 11 \\ \hline 3 \quad 18 \\ \hline 418 \end{array}$$



A godown building is in the form as shown in Fig. The vertical cross-section parallel to the width side of the building is a rectangle  $7\text{ m} \times 3\text{ m}$ , mounted by a semi-circle of radius  $3.5\text{ m}$ . The inner measurements of the cuboidal portion of the building are  $10\text{ m} \times 7\text{ m} \times 3\text{ m}$ .

Find the volume of the godown  
and the total interior surface  
area excluding the floor (base).

(Take  $\pi = 22/7$ )




Soln:

Volume of the godown:-

= Volume of cuboid +  $\frac{1}{2}$  [Volume of  
Cylinder]

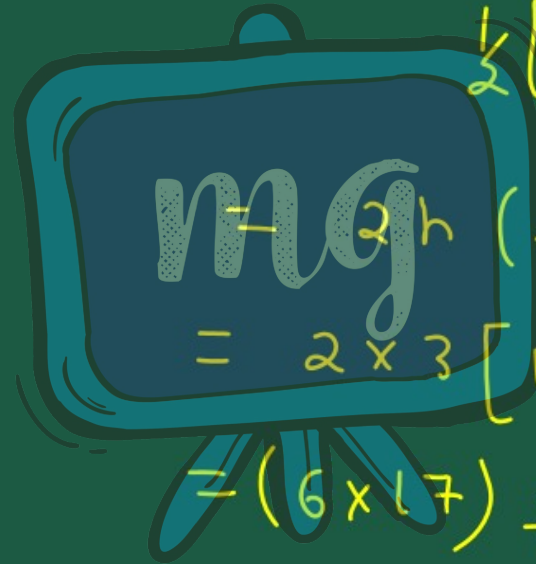
$$= l \times b \times h + \frac{1}{2} \times \pi r^2 h$$

$$= 10 \times 7 \times 3 + \frac{1}{4} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 10$$


$$\begin{aligned} &= 210 + \frac{770}{4} \\ &= 210 + 192.5 \\ &= 402.5 \text{ cm}^3 \end{aligned}$$

$$SA = LSA \text{ of Cuboid} +$$

$$\frac{1}{2} [TSA \text{ of cylinder}]$$



$$= 2h(l+b) + \frac{1}{2} [2\pi r(r+h)]$$

$$= 2 \times 3 [10+7] + \frac{22}{7} \times \frac{7}{2} \times \left[\frac{7}{2} + 10\right]$$

$$= (6 \times 17) + 11 \left[\frac{27}{2}\right]$$

$$= 102 + \frac{297}{2} = 250.5$$

5. A right triangle, whose sides are 15 cm and 20 cm, is made to revolve about its hypotenuse. Find the volume and surface area of the double cone so formed. (Use  $\pi = 3.14$ )



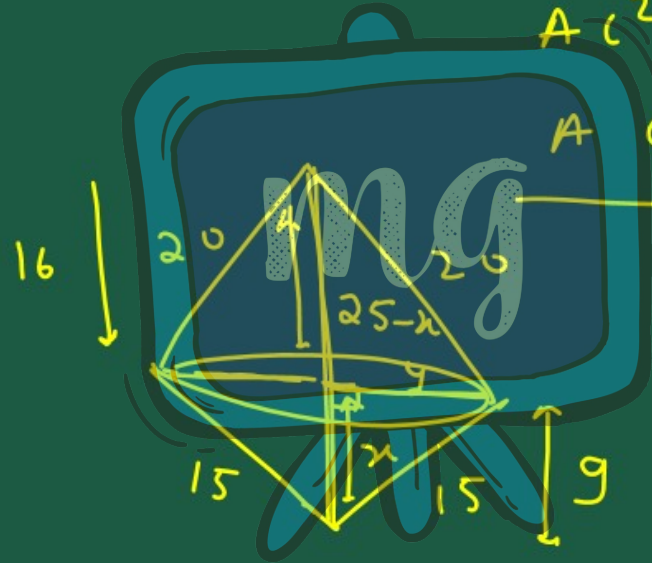
Soln: By Pythagoras The.

$$\begin{aligned}
 A^2 &= B^2 + C^2 \\
 &= 20^2 + 15^2 \\
 &=
 \end{aligned}$$

$$AC^2 = 400 + 225$$

$$AC^2 = 625$$

$$AC = 25 \text{ cm}$$



$$x^2 + y^2 = 15^2 \quad \text{--- (1)}$$

$$(25-x)^2 + y^2 = 20^2 \quad \text{--- (2)}$$

$$\begin{array}{r} - \quad - \quad - \\ \hline x^2 - (25-x)^2 = 15^2 - 20^2 \end{array}$$

$$x^2 - (25 - x)^2 = 15^2 - 20^2$$
$$= 225 - 400$$

$$x^2 - [25^2 + x^2 - 50x] = -175$$

$$x^2 - 25^2 - x^2 + 50x = -175$$

$$50x = -175 + 625$$

$$50x = 450$$

$$x = 9 \text{ cm}$$



$$x^2 + y^2 = 15^2$$

$$9^2 + y^2 = 15^2$$

$$y^2 = 15^2 - 9^2$$

$$= 225 - 81$$

$$y^2 = 144$$

$$y = \pm 12$$

$$y = +12 \text{ cm}$$

Volume of the double cone :-

$$= \frac{1}{3} \pi r^2 h_1 + \frac{1}{3} \pi r^2 h_2$$

$$= \frac{1}{3} \pi r^2 [h_1 + h_2]$$

$$= \frac{1}{3} \times 3.14 \times 12^2 \times 25$$

$$= \frac{1}{3} \times 3.14 \times 144 \times 25$$

Volume of the Double Cone = 3768 cm<sup>3</sup>

SA: - CSA of Cone 1 + CSA of

Cone-2

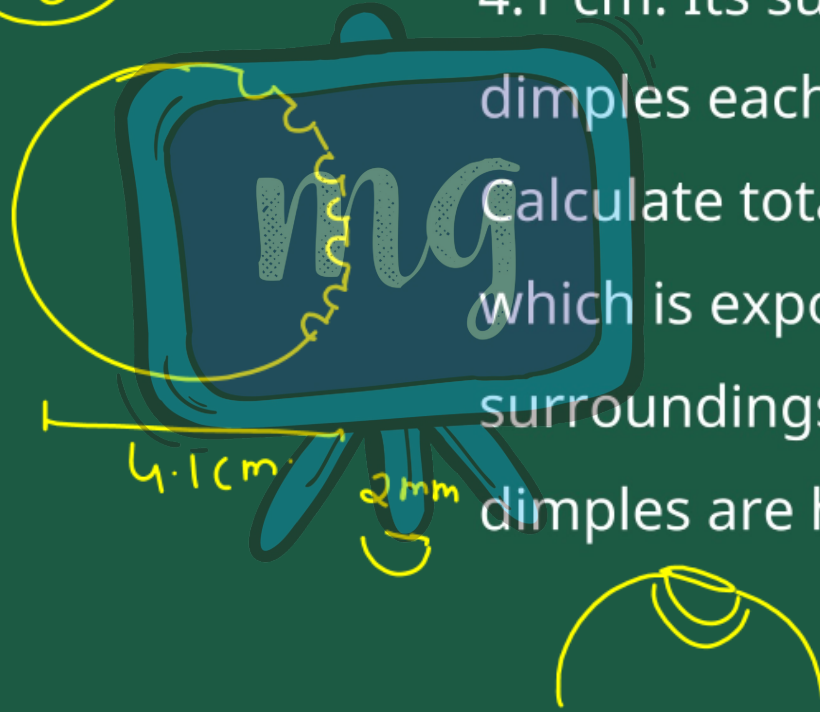
$$= \pi r l_1 + \pi r l_2$$

$$= \pi r [l_1 + l_2]$$

$$= 3.14 \times 12 [15 + 20]$$

$$= 3.14 \times 12 \times 35$$

Surface area of Double Cone = 1318.8 cm<sup>2</sup>

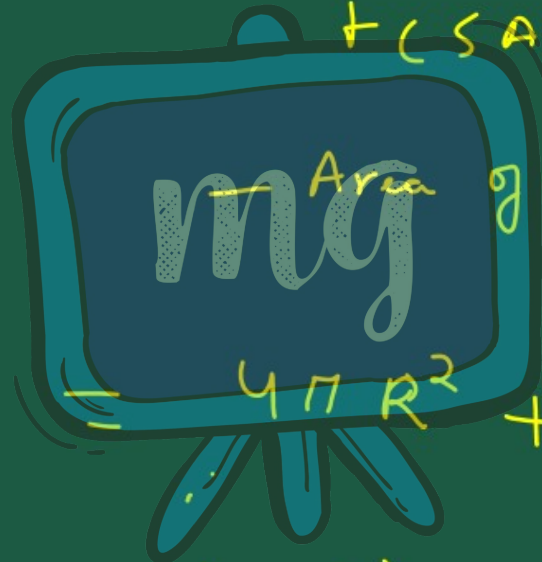


6. A golf ball has diameter equal to 4.1 cm. Its surface has 150 dimples each of radius 2 mm. Calculate total surface area which is exposed to the surroundings assuming that the dimples are hemispherical.

SA! SA of Spherical shape

+ CSA of hemisphere  $\times 150$

Area of circle  $\times 150$



$$= 4\pi R^2 + (150) 2 (\pi r^2)$$

$$- 150 (\pi r^2)$$

$$= 4\pi R^2 + 150 \pi r^2$$

$$= \pi [4R^2 + 150r^2]$$

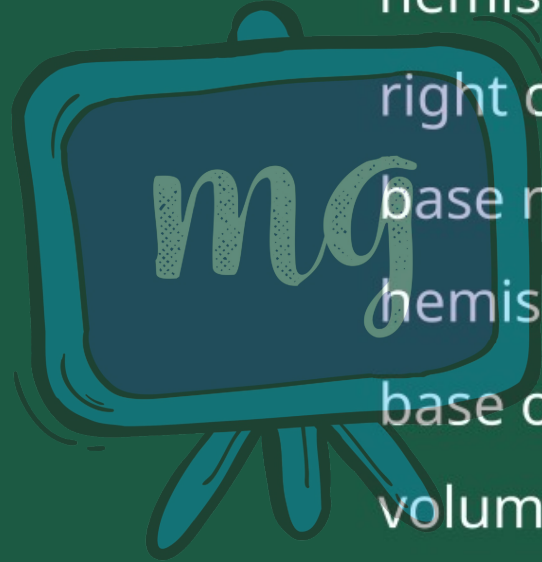
$$= \frac{22}{7} \left[ 4 \times (4.1)^2 + 150 \times \left(\frac{2}{10}\right)^2 \right]$$

$$= \frac{22}{7} \left[ 4 \times 4.1 \times 4.1 + 150 \times \frac{1}{25} \right]$$

$$= \frac{22}{7} [4 \times 4.1 \times 4.1 + 6]$$

Total surface area exposed = 71.68 cm<sup>2</sup>

7. A toy is in the form of a hemisphere surmounted by a right circular cone of the same base radius as that of the hemisphere. If the radius of the base of the cone is 21 cm and its volume is  $\frac{2}{3}$  of the volume of the hemisphere,



calculate the height of the cone  
and the surface area of the toy.

(Use  $\pi = 22/7$  )



8. A wall 24 m long, 0.4 m thick and 6 m high is constructed with the bricks each of dimensions 25cm × 16cm × 10cm. If the mortar occupies  $\frac{1}{10}$  th of the volume of the wall, then find the number of bricks used in constructing the wall.

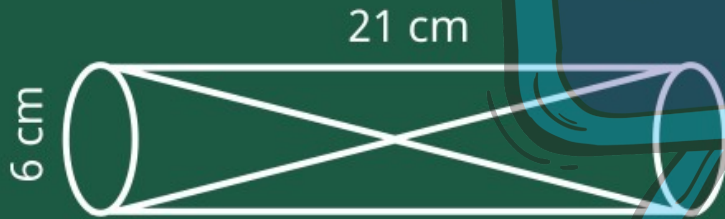


9. A cone of maximum size is carved out from a cube of edge 14 cm.

Find the surface area of the cone and of the remaining solid left out after the cone carved out.



10. Two solid cones A and B are placed in a cylindrical tube as shown in Fig. The ratio of their capacities are 2 : 1. Find the heights and capacities of the cones. Also, find the volume of the remaining portion of the cylinder.



11. In Fig. from a cuboidal solid metallic block, of dimensions  $15\text{cm} \times 10\text{cm} \times 5\text{cm}$ , a cylindrical hole of diameter  $7\text{cm}$  is drilled out. Find the surface area of the remaining block. (Take  $\pi = 22/7$ )

