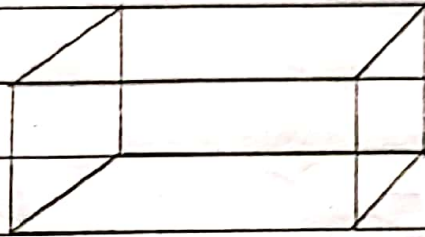


SURFACE AREA AND VOLUMES

Surface Areas and Volumes of solid objects

1) Cuboid



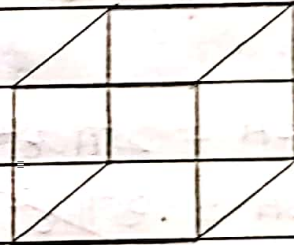
Total surface area of cuboid = $2(lb + bh + hl)$

Volume of cuboid = lbh

2) Cube

$$\text{ TSA } = 6a^2$$

$$\text{ Volume } = (a)^3$$

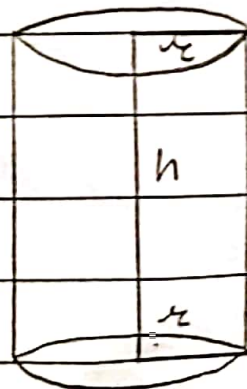


3) Cylinder

$$\text{ CSA } = 2\pi rh$$

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

$$\text{ Volume } = \pi r^2 h$$

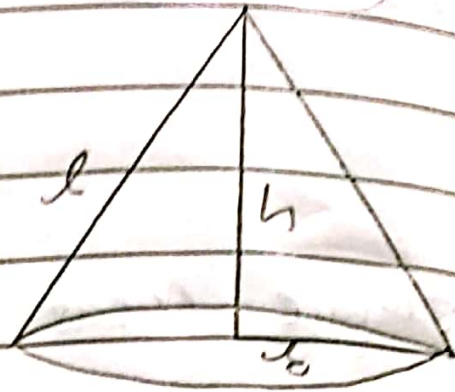


4) Cone

$$CSA = \pi r l$$

$$TSA = \pi r (l + r)$$

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

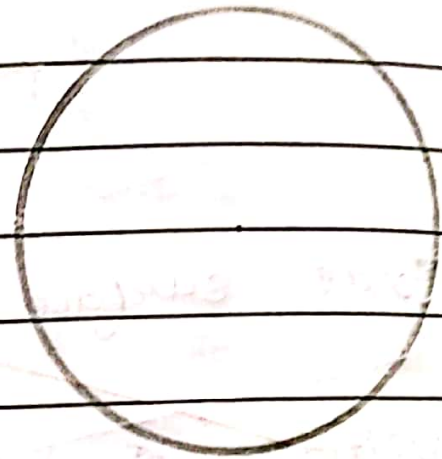


5) Sphere

$$CSA = TSA =$$

$$4\pi r^2$$

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

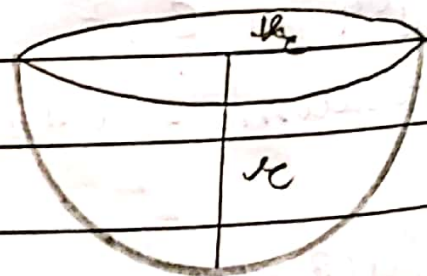


6) Hemisphere

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

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

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



Two cubes $\dots\dots\dots$ resulting cuboid.

$$\text{Volume of cube} = (a)^3$$

$$64 \text{ cm}^3 = (\text{side})^3$$

$$\text{side} = \sqrt[3]{64}$$

$$\text{side} = 4 \text{ cm}$$

\therefore Side of one cube = 4 cm

For cuboid,

$$l = 8 \text{ cm}$$

$$b = 4 \text{ cm}$$

$$h = 4 \text{ cm}$$

Surface

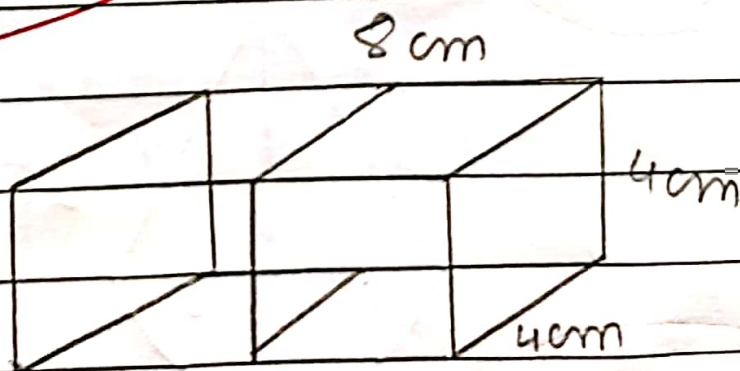
$$\text{Area of cuboid} = 2(lb + bh + hl)$$

$$= 2(8 \times 4 + 4 \times 4 + 4 \times 8)$$

$$= 2(32 + 16 + 32)$$

$$= 2(80)$$

$$= 160 \text{ cm}^2$$



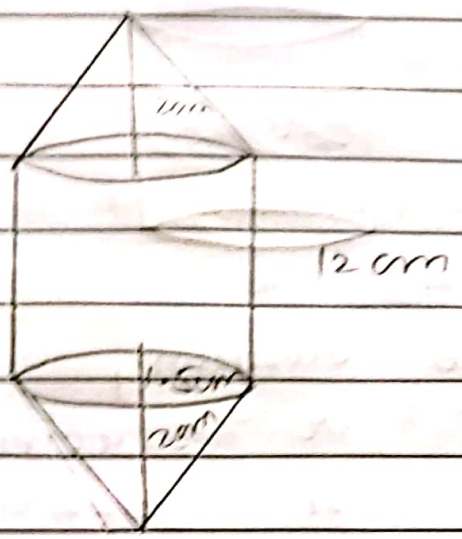
Rachel, - - - - - Rachel made

Cone,
 $h = 2 \text{ cm}$

$r = 1.5 \text{ cm}$

Cylinder,
 $h_2 = 8 \text{ cm}$

$r = 1.5$



Volume of die = Volume of cylinder +
Volume of 2 cones

$$= \pi r^2 h_2 + 2 \times \left(\frac{1}{3} \times \pi r^2 h \right)$$

$$= \pi r^2 \left(\frac{h_2 + 2 \times h}{3} \right)$$

$$= \frac{22}{7} \times 1.5 \times 1.5 \left(\frac{8 + 2 \times 2}{3} \right)$$

$$= \frac{22}{7} \times 2.25 \times \left(\frac{8 + 4}{3} \right)$$

$$= \frac{49.50}{7} \times \left(\frac{284}{3} \right)$$

$$= \frac{198}{3}$$

$$= 66 \text{ cm}^3$$

A metallic ~~-----~~ cylinder

For cylinder,

$$R = 6 \text{ cm}$$

Metallic sphere,

$$r = 4.2 \text{ cm}$$

Volume of sphere = Volume of cylinder

$$\frac{4}{3} \pi r^3 = \pi R^2 h$$

$$\frac{4}{3} \times (4.2)^3 = (6)^2 \times h$$

$$\frac{4}{3} \times 1.4 \times 0.7 \times 0.7 = 4$$

$$6 \times 6$$

$$4 \times 1.4 \times 0.7 \times 0.7 = 4$$

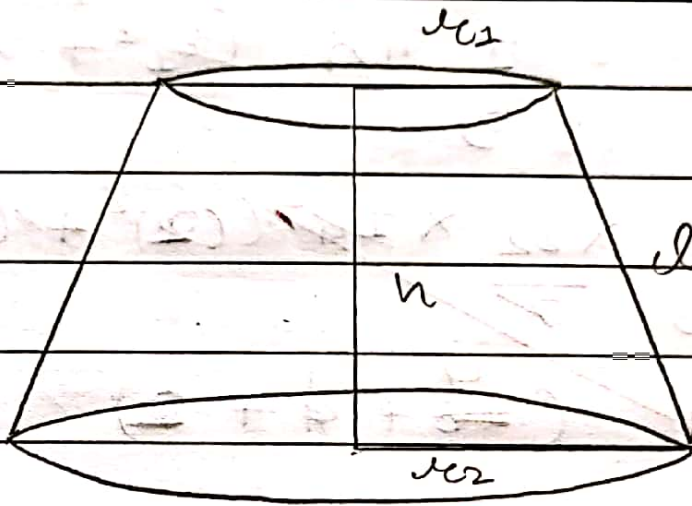
$$4 \times 1.4 \times 0.49 = 4$$

$$5.6 \times 0.49 = 4$$

$$h = 2.744 \text{ cm}$$

FRUSTUM OF A CONE

If a cone is cut with a plane parallel to its base then the solid so formed on the bottom side of the cone is called frustum of the cone.



$$\text{Volume} = \frac{1}{3} \pi h (r_1^2 + r_2^2 + r_1 r_2)$$

$$\text{CSA} = \pi (r_1 + r_2) l$$

$$l = \sqrt{h^2 + (r_1 - r_2)^2}$$

$$\text{TSA} = \pi l (r_1 + r_2) + \pi r_1^2 + \pi r_2^2$$

$$l = \sqrt{h^2 + (r_1 - r_2)^2}$$

2] The slant height --- the frustum

$$l = 4 \text{ cm}$$

$$C_1 = 2\pi r_1 = 18$$

$$\frac{2 \times 22 \times r_1}{7} = 18$$

$$\frac{22 \times r_1}{7} = 9$$

$$r_1 = \frac{9 \times 7}{22} = \frac{63}{22}$$

$$C_2 = 2\pi r_2 = 6$$

$$\frac{2 \times 22 \times r_2}{7} = 6$$

$$\frac{22 \times r_2}{7} = 3$$

$$r_2 = \frac{3 \times 7}{22}$$

$$r_2 = \frac{21}{22}$$

$$CSA = \pi (r_1 + r_2) l$$

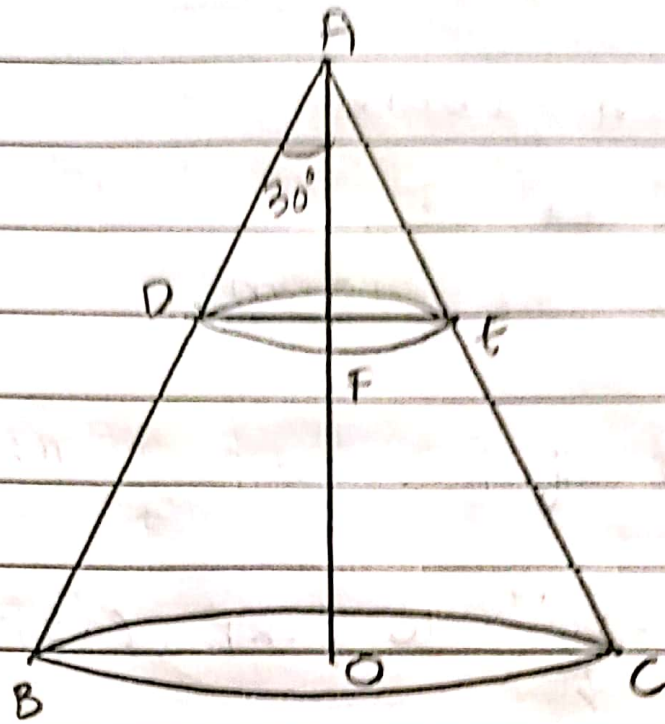
$$= \frac{22}{7} \times \left(\frac{63}{22} + \frac{21}{22} \right) \times 4$$

$$= \frac{22}{7} \times \frac{12}{22} \times 4$$

$$= 48 \text{ cm}^2$$

A metallite

the wire



$$h_1 = BO$$

$$h_2 = DF$$

$$\text{In } \triangle AOB, \frac{h_1}{(h_1 + h_2)} = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$h_1 = (h_1 + h_2) \times \frac{1}{\sqrt{3}}$$

$$= 20 \times \frac{1}{\sqrt{3}}$$

$$\text{In } \triangle ADF, \frac{h_2}{h_1} = \tan 30^\circ$$

$$h_2 = h_1 \times \frac{1}{\sqrt{3}}$$

$$= 10 \times \frac{1}{\sqrt{3}}$$

$$\text{Volume of frustum} = \frac{1}{3} \pi h_2 (r_1^2 + r_2^2 + r_1 r_2)$$

$$= \frac{1}{3} \times \pi \times 10 \left[\left(\frac{20}{\sqrt{3}}\right)^2 + \left(\frac{10}{\sqrt{3}}\right)^2 + \frac{20}{\sqrt{3}} \times \frac{10}{\sqrt{3}} \right]$$

$$= \frac{\pi}{3} \times 10 \left[\frac{400}{3} + \frac{100}{3} + \frac{200}{3} \right]$$

$$= \frac{\pi}{3} \times 10 \left(\frac{700}{3} \right)$$

Let l be length & D be diameter.

Since the wire is in form of cylinder,

$$\text{Volume} = \pi r^2 h$$

$$= \pi \left(\frac{D}{2}\right)^2 \times l = \frac{\pi D^2 l}{4}$$

$$= \frac{\pi l}{4 \times 16 \times 16}$$

$$\therefore D = \frac{1}{16}$$

Volume of frustum = Volume of wire

$$\frac{\pi}{3} \times 10 \times \frac{700}{3} = \frac{\pi l}{4 \times 16 \times 16}$$

$$l = \frac{10 \times 700}{3 \times 3} \times \frac{4 \times 16 \times 16}{\pi} = \frac{7168000}{9 \times 100}$$

$$= 7964.44 \text{ m}$$