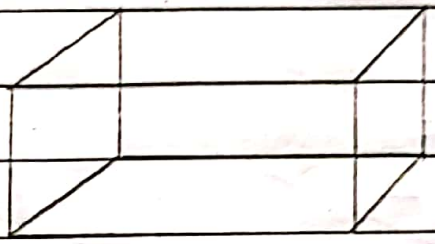
SURFACE AREA AND VOLUMES

Surface Areas and Volumes of solid objects

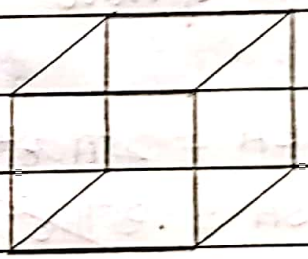
1) Cuboid



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

Volume of cuboid = lbh

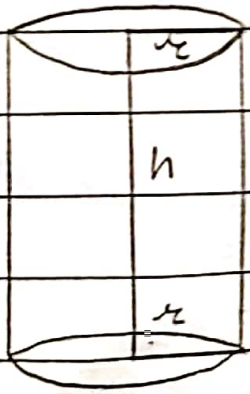
2) Cube



TSA = $6a^2$

Volume = $(a)^3$

3) Cylinder

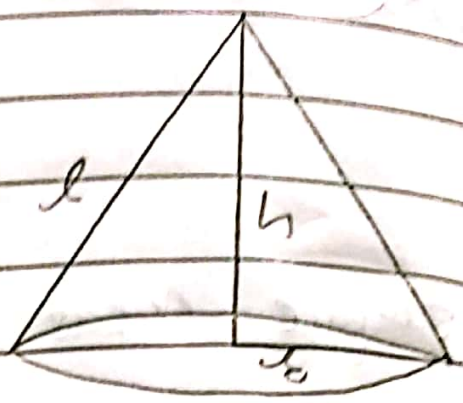


CSA = $2\pi rh$

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

Volume = $\pi r^2 h$

4] Cone

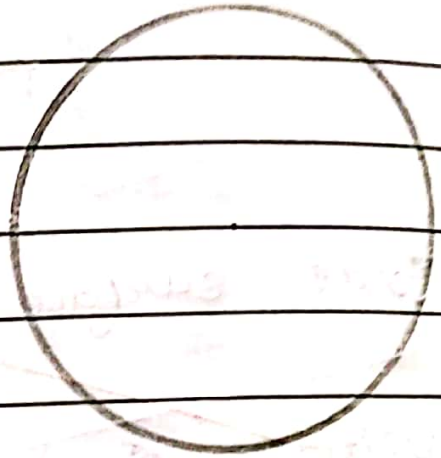


CSA = $\pi r l$

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

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

5] Sphere

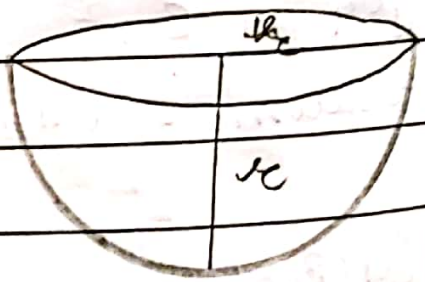


CSA = TSA =

$4\pi r^2$

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 ---------- resulting cuboid.

Volume of cube $= (a)^3$

$64\ cm^3 = (side)^3$

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

$side = 4\ cm$

So Side of one cube $= 4\ cm$

For cuboid,

$l = 8\ cm$

$b = 4\ cm$

$h = 4\ cm$

Surface

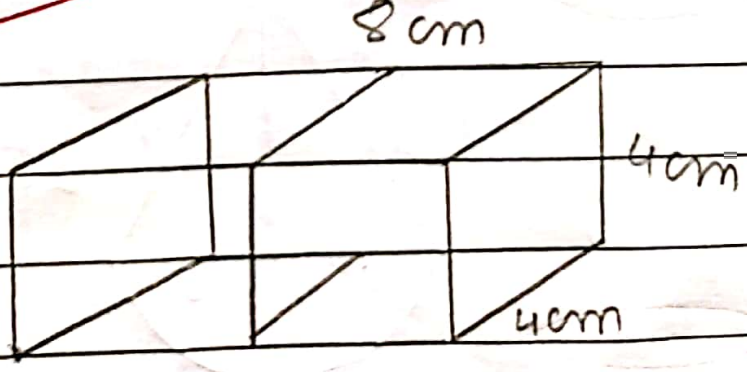
Area of cuboid $= 2(lb + bh + hl)$

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

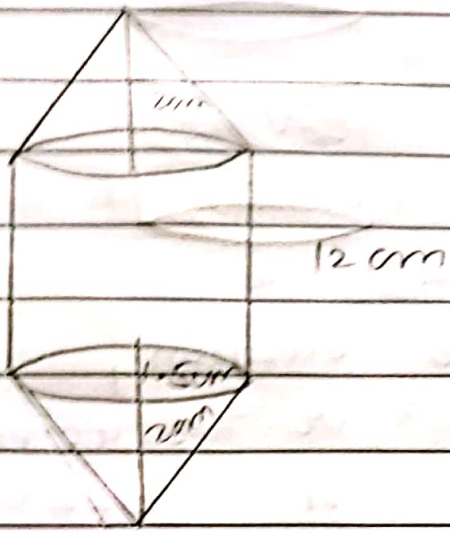
$= 2(32 + 16 + 32)$

$= 2(80)$

$= 160\ cm^2$



Rachel, - - - - - - - - Rachel made.



Cone,
$h = 2\,cm$
$r = 1.5\,cm$

Cylinder,
$h_2 = 8\,cm$
$r = 1.5$

Volume of air = Volume of cylinder + Volume of 2 cones

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

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

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

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

$= \frac{49.50}{7} \times \left(\frac{28}{3}\right)$

$= \frac{198}{3}$

$= 66\,cm^3$

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

For cylinder,

$R = 6cm$

Metallic sphere,

$r = 4.2cm$

Volume of sphere = Volume of cylind

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

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

$\frac{4}{3} \times 4.2 \times 4.2 \times 4.2 = h$

$1.4 \times 0.7 \times 0.7$

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

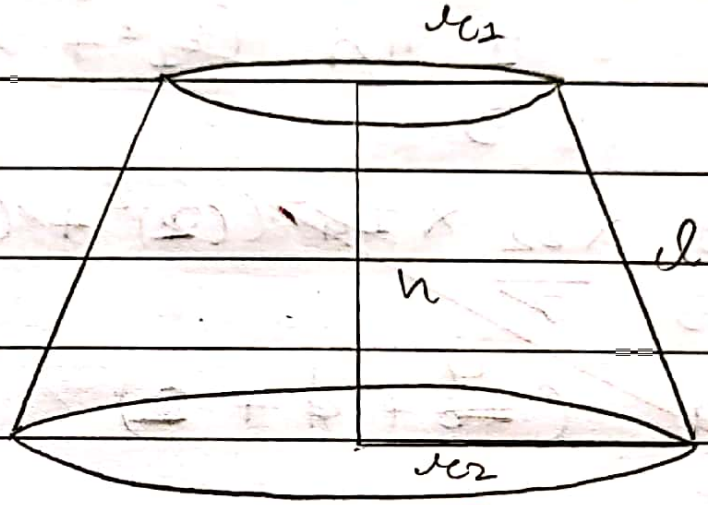
$4 \times 1.4 \times 0.49 = h$

$5.6 \times 0.49 = h$

$h = 2.744\ cm$

FRUSTUM OF A CONE

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



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

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

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

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

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

2] The slant height — — — — the frustum

→ $l = 4\,cm$

$C_1 = 2\pi r_1 = 18$

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

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

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

$C_2 = 2\pi r_2 = 6$

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

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

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

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

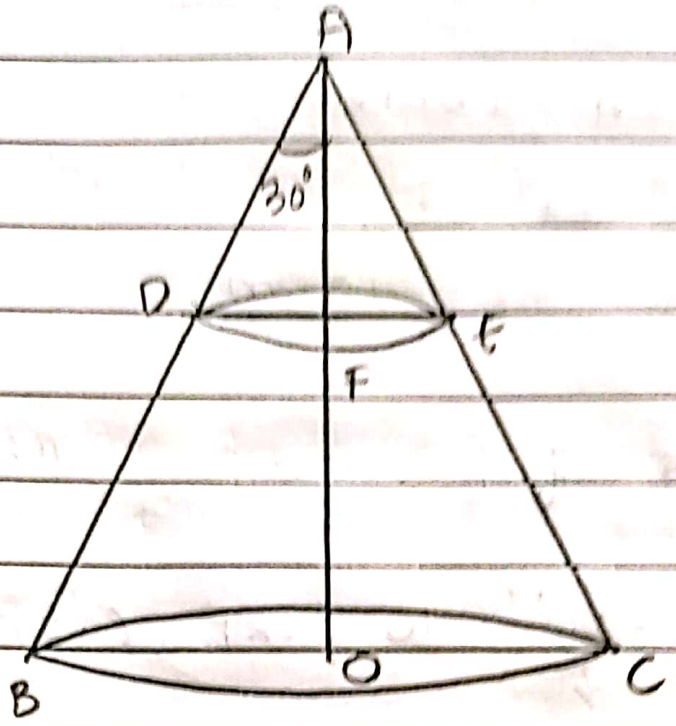
$CSA = \pi (r_1 + r_2) l$

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

$= \frac{\cancel{22}}{\cancel{7}} \times \frac{\overset{12}{\cancel{84}}}{\cancel{22}} \times 4$

$= 48\,cm^2$

A metallic ... the wire,



$r_1 = BO$

$r_2 = DF$

In $\triangle ADB$, $\frac{r_1}{(h_1 + h_2)} = \tan 30° = \frac{1}{\sqrt{3}}$

$r_1 = (h_1 + h_2) \times \frac{1}{\sqrt{3}}$

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

In $\triangle ADF$, $\frac{r_2}{h_1} = \tan 30$

$r_2 = h_1 + \times \frac{1}{\sqrt{3}}$

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

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

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

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

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

Let l be length & D be diameter.

Since the wire is in form of cylinder,

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 frustrum = Volume of wire

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

$l = \frac{10 \times 700}{3 \times 3} \times 4 \times 16 \times 16 = \frac{71680000}{9 \times 100}$