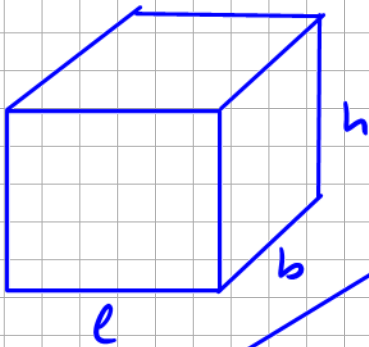


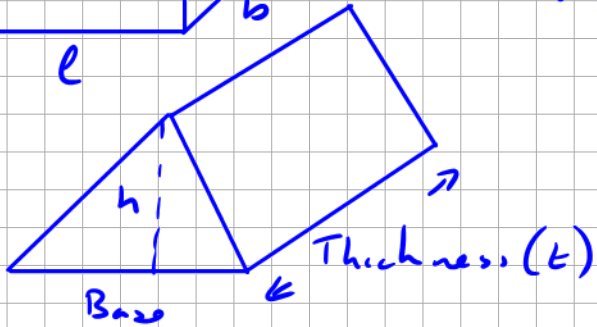
Volume.

Basic Shapes.

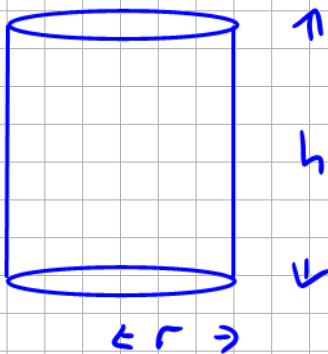


$$V = l \times b \times h$$

Volume = Area \times height.



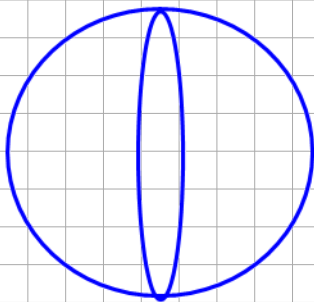
$$V = \text{Area} \times \text{thickness} = \frac{1}{2} b \cdot h \cdot t$$



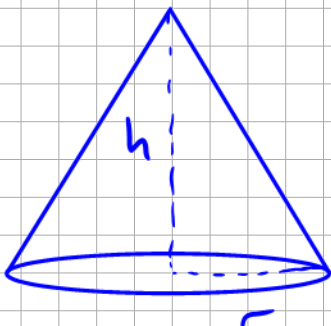
$$V = \pi r^2 h$$

Curved $A = 2\pi r h$

Solid = Curved area + 2 circles.



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



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

Melt down and Recast.

Volume stays the same.

A sphere of radius 9 cm is melted down and recast as cone of radius 6 cm. Find height of cone.

Sphere $r = 9$

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

$$= \frac{4}{3} \pi (9)^3 = 972 \pi \text{ cm}^3$$

Cone $r = 6$ $V = 972 \pi$

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

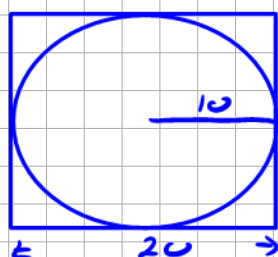
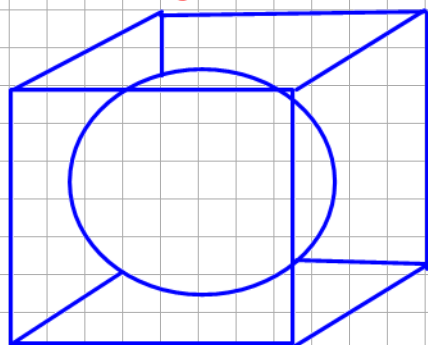
$$972 \pi = \frac{1}{3} \pi (6)^2 h$$

$$972 = 12h$$

$$h = 81 \text{ cm}$$

Box Up.

A solid sphere of radius 10 cm is placed in smallest possible cube. Find percentage of empty space.



↑

20

Space = Box - sphere

Sphere $r = 10$

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

$$= \frac{4}{3} \pi (10)^3$$

$$= 4188.79$$

Box $l = 20$ $b = 20$ $h = 20$

$$V = l \times b \times h$$

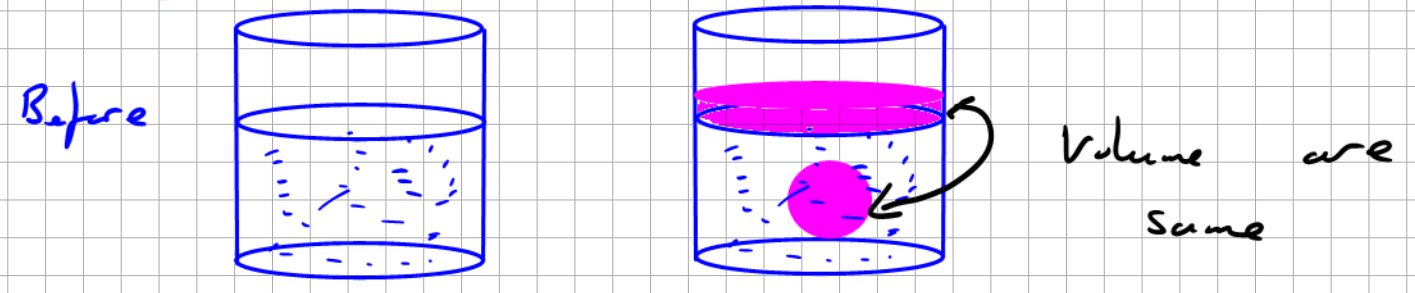
$$= 20^3 = 8000$$

$$\begin{aligned} \text{Space} &= 8000 - 4188.79 \\ &= 3811.2 \end{aligned}$$

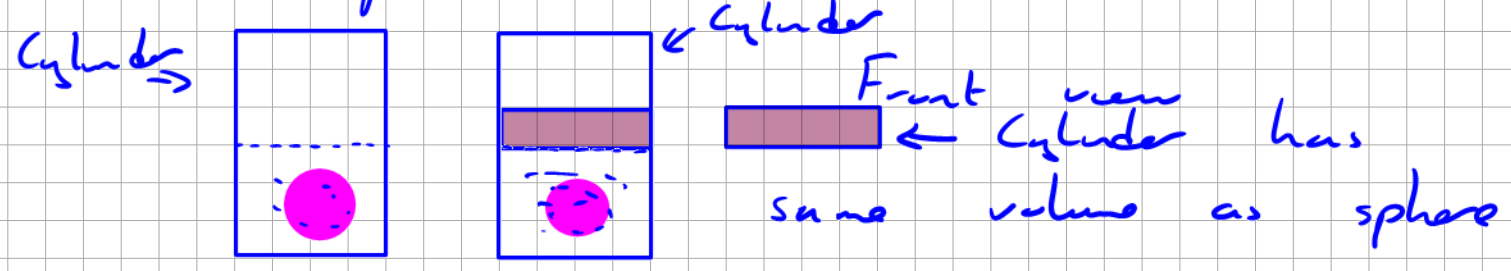
$$\begin{aligned} \% \text{ Space} &= \frac{\text{Space}}{\text{Total}} \times \frac{100}{1} \\ &= \frac{3811.2}{8000} \times \frac{100}{1} = 47.6\% \end{aligned}$$

Water Displacement

A cylinder of radius 6cm is partly filled with water. A sphere of radius 3cm is submerged in water. Find the increase in the height of water in cylinder.



Water increase by same volume as the sphere thrown in.



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

$$= \frac{4}{3} \pi (3)^3 = 36\pi$$

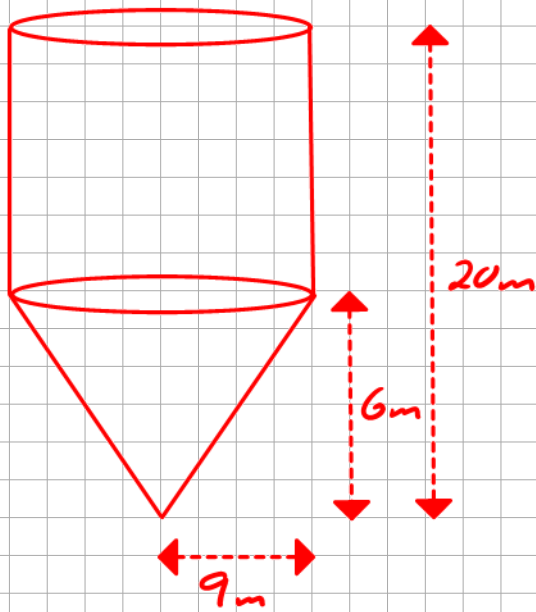
Cylinder $r = 6$ $V = 36\pi$

$$V = \pi r^2 h$$

$$\pi r^2 h = 36\pi$$

$$36h = 36 \quad h = 1 \text{ cm}$$

Double Shapes.



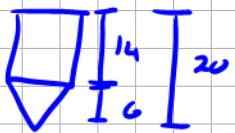
Find volume in terms of π .
 Grain equal to half total volume is poured in. How high is grain in silo.

Cone + Cylinder
 Cone $r = 9$ $h = 6$

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

$$= \frac{1}{3} \pi (9)^2 (6) = 162\pi$$

Cylinder



$$r = 9 \quad h = 14$$

$$V = \pi r^2 h$$

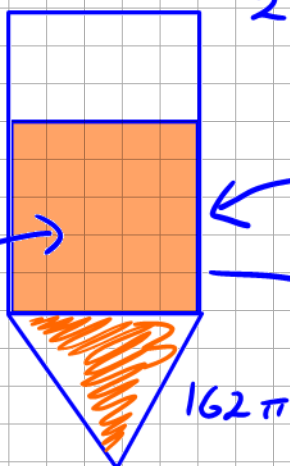
$$= \pi (9)^2 (14) = 1134\pi$$

Total $1296\pi \text{ m}^3$

$$\text{Grain} = \frac{1296\pi}{2} = 648\pi$$

Front view

Grain



Cone is full (first)
 Rest of grain into cylinder.

$$648\pi - 162\pi = 486\pi$$

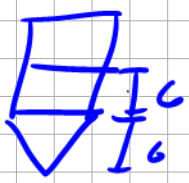
Cylinder

$$r = 9 \quad V = 486\pi$$

$$\pi r^2 h = V$$

$$\pi (9^2) h = 486$$

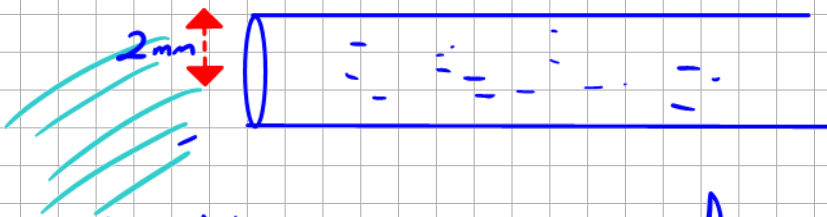
$$h = 6\text{m}$$



Ans $6 + 6 = 12 \text{ m}$

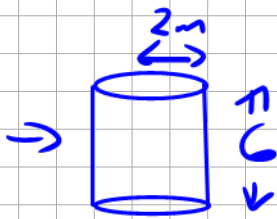
Rate of flow.

Water flows through a cylindrical pipe of radius 2mm at rate of 6mm/sec. How long will it take 5 litres to flow through the pipe to nearest second?



Rate of flow = 6 = freeze the pipe and let cylindrical cubes out per second.

Cube Frozen



Cylinder

$r = 2$

$h = 6$

$V = \pi r^2 h$

$= \pi (2)^2 (6) = 24\pi \text{ mm}^3$
per second.

Time = $\frac{5 \text{ Litre}}{24\pi \text{ mm}^3}$

1 litre = $1,000,000 \text{ mm}^3 = \frac{5,000,000}{24\pi}$

$1 \text{ cm}^3 = 1,000 \text{ mm}^3 = 66,314.5$

$= 66,315 \text{ cm}$

1 litre = $1,000 \text{ cm}^3$