

2. Volume of solids

1	Volume of cube = $4.4 \times 4.4 \times 4.4$ Volume of sphere $\frac{22}{7} \times r^3 = 4.4 \times 4.4 \times 4.4$ $r^3 = 4.4 \times 4.4 \times 4.4 \times \frac{7}{22} \times \frac{3}{4}$ $r^3 = 20.328$ $r = 2.73 \text{ cm} \quad (3 \text{ s.f.})$	M₁ M₁ A₁	
2.	Vol. of sphere = $\frac{4}{3} \pi r^3 + \frac{4}{3} \pi r^3$ $= \frac{4}{3} \times \frac{22}{7} (2.3^3 + 3.86^3)$ $= \frac{88}{21} \times 69.679456$ $= 291.990$ Remaining material $\left(\frac{19}{20} \times 291.990 \right)$ $= 277.297$ No of slabs = $\frac{277.297}{3.142 \times 0.8^2 \times 7}$ $= 19.699$ $= 19 \text{ slabs}$	M1 M1 M1 A1	Follow through $\frac{22}{7}$ as π is used
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1. a) Length of diagonal = $\sqrt{10^2 + 8^2}$
 $= \sqrt{164}$

Vertical height = $\sqrt{16^2 - \left(\frac{\sqrt{164}}{2} \right)^2}$
 $= 14.66 \text{ cm}$

b) Height of the slant surfaces

$$\sqrt{16^2 - 4^2} = \sqrt{240}$$

$$\sqrt{16^2 - 5^2} = \sqrt{231}$$

Area of slant surfaces

$$(\frac{1}{2} \times 8 \times \sqrt{240} \times 2) = 124.0 \text{ cm}^2$$

$$(\frac{1}{2} \times 10 \times \sqrt{231} \times 2) = 152.0 \text{ cm}^2$$

$$\text{Area of the rectangular base} = 8 \times 10 = 80 \text{ cm}^2$$

$$\text{Total surface area} = \underline{356 \text{ cm}^2}$$

c) Volume

$$= (\frac{1}{3} \times 80 \times 14.66) = 391.0 \text{ cm}^3$$

2. Volume of the cylinder

$$= (\frac{22}{7} \times 6 \times 6 \times 12) \text{ cm}^3 = 1357.71 \text{ cm}^3$$

Volume of a sphere

$$= (\frac{4}{3} \times \frac{22}{7} \times 3 \times 3 \times 3) \text{ cm}^3 = 113.14 \text{ cm}^3$$

$\therefore$ No. of spheres formed

$$= \frac{1357.71}{113.14 \text{ cm}^3}$$

$$= 12 \text{ spheres}$$

3. Let the smaller length be x cm

$\therefore$ Dimensions are $x, 2x, 3x$

$$x \cdot 2x \cdot 3x = 1024$$

$$6x^3 = 1024$$

$$x^3 = \frac{1024}{6}$$

$$6$$

$$x = 3\sqrt[6]{1024}$$

$$6$$

Dimensions are 5.547, 11.09, 16.64

$$4. (\frac{60}{360} \times \frac{22}{7} \times 24 \times 24) - (\frac{60}{360} \times \frac{22}{7} \times 12 \times 12)$$

$$301.71 - 75.43 = 226.26$$

$$5. (a)(i) \quad 2\pi rh + 2r\pi^2 + \pi r^2$$

$$= 2 \times \frac{22}{7} \times 1.4 \times 1.4 + 2 \times \frac{22}{7} \times 1.42 + (\frac{22}{7} \times 1.42) \text{ m}^2$$

$$= (12.32 + 12.32 + 6.16) \text{ m}^2 = 30.8 \text{ m}^2$$

$$\text{OR} \quad r(2h + 2r + r)$$

$$= 22 \times 1.4 (2 \times 1.4 + 3(1.4)) = 30.8 \text{ m}^2$$

$$(ii) \quad \text{shs. } (75 \times 30.8) = \text{Shs. } 2,310$$

(iii) Total vol.

$$= (\frac{22}{7} \times 1.42 \times 1.4) + (\frac{1}{2} \times \frac{4}{3} \times \frac{22}{7} \times 1.42) \text{ m}^3$$

$$= 8.624 + 4.106 = 12.7306 \text{ m}^3$$

$$\text{capacity} = (12.7306 \times 1000) \text{ liters} = 12730.6 \text{ litres}$$

$$(b) \quad \text{First 2 days} = 185 \times 2 = 370 \text{ litres}$$

$$\text{Remaining amount} = (12730.6 - 370) \text{ litres}$$

$$= 12360.6 \text{ litres}$$



$$\text{Days to use} = \frac{12,360.6}{200}$$

$$= 61.803 \text{ days}$$

$$\text{In all it takes} = (61.803 + 2) \text{ days} = 63.803 \text{ days}$$

$$6. \quad a) \quad \frac{h}{6} + 3 = 9 \quad \checkmark$$

$$6h + 18 = 9h$$

$$h = 6 \text{ cm} \quad \checkmark$$

$$\text{height} = \underline{6 + 3 = 9 \text{ cm}}$$

$$b) \quad \text{Base} = 9 \times 9 = 81 \text{ cm}^2$$

$$\text{Top} = 6 \times 6 = 36 \text{ cm}^2$$

$$\text{Sides} = 3.67 \times 15 \times \frac{1}{2} \times 4$$

$$= 110.15 \text{ cm}^2$$

$$\text{Total} = \underline{227.15 \text{ cm}^2}$$

$$c) \quad \text{Vol. of bigger} = \frac{1}{3} \times 81 \times 9$$

$$= 243$$

$$\text{Vol of smaller} = \frac{1}{3} \times 36 \times 6$$

$$\quad \quad \quad \checkmark \quad \quad \quad = 72$$

$$\text{Vol. of frustrum} = \underline{171 \text{ cm}^2}$$

$$d) \quad \sin \theta = \frac{9}{11.02}$$

$$\theta = \underline{54.8^\circ}$$

$$7. \quad \text{Volume of a hemisphere}$$

$$\frac{2}{3} \pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 12 \times 12 \times 12$$

$$= \frac{176}{7} \times 144$$

$$= 3620.571429 = 3620.57$$

$$\text{Volume of a cone}$$

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

$$\frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times h = 3620.57$$

$$\underline{\frac{6 \times 44h}{7}} = 3620.57$$

$$264h = 3620.57 \times 7$$

$$h = \frac{3620.57 \times 7}{264}$$

$$= 95.9981 = 95.998$$

$$8. \quad V = \left[\frac{\quad}{7} \right] + \left[\frac{\quad}{7} \right] + \left[\frac{\quad}{7} \right]$$

$$= \frac{132}{7} + \frac{297}{7} + \frac{528}{7}$$

$$\text{V of hole} = \frac{22}{7} \times 1 \times 1 \times 4.5$$

$$= \underline{99}$$

$$V = \frac{957}{7} - \frac{99}{7} = \frac{858}{7} = 122.57 \text{ cm}^3$$

$$\begin{aligned} \text{Mass} &= 2.8 \times 122.57 \\ &= 343.196\text{g} \\ &\approx 343.2\text{g} \end{aligned}$$

$$9. \quad \text{Volume of hemisphere} = \frac{1}{2} \times \frac{4}{3} \times \frac{22}{7} \times 7 \times 7 = 718.67 \text{ cm}^3$$

$$\text{Vol. of cylinder} = \pi r^2 h = \frac{22}{7} \times 7 \times 5 = 770 \text{ cm}^3$$

$$\begin{aligned} \text{Vol of frustrum} &= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times h_1 - \\ &\quad \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times h_2 \end{aligned}$$

$$\text{Height of cone} \Rightarrow \frac{h_1}{h_2} = \frac{7}{3.5} \quad \text{but } h_1 = h_2 + 6$$

$$\frac{h_2 + 6}{h_2} = \frac{7}{3.5} \Rightarrow 7h_2 = 3.5h_2 + 21$$

$$3.5 h_2 = 21$$

$$h_2 = 6 \text{ cm}$$

$$h_1 = 12 \text{ cm}$$

$$\therefore \text{Vol. of frustrum} = \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 12 -$$

$$\frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 6$$

$$= 616 - 77 = 539 \text{ cm}^3$$

$$\begin{aligned} \text{Total volume} &= 718.67 \text{ cm}^3 + 770 \text{ cm}^3 + 539 \text{ cm}^3 \\ &= 2027.67 \text{ cm}^3 \end{aligned}$$

$$a) \quad \text{S.A of top} = \pi r^2 \times 3.5 = 38.5 \text{ cm}^2$$

$$\text{S.A of curved part of frustrum} = \frac{22}{7} \times 7 \times 13.89 -$$

$$\frac{22 \times 3.5 \times 6.945}{7}$$

$$305.580$$

$$- \frac{76.395}{7}$$

$$229.185 \text{ cm}^2$$

$$\begin{aligned} \text{S.A of curved part of cylinder} &= 2\pi r \times h = 2 \times \frac{22}{7} \times 7 \times 5 \\ &= 2220 \text{ cm}^2 \end{aligned}$$

$$S.A \text{ of hemisphere} = \frac{1}{2} \times 4 \pi r^2 = \frac{22}{7} \times 7 \times 7 = 308 \text{ cm}^2$$

$$\text{Total S.A} = \underline{795.685 \text{ cm}^2}$$

$$10. \quad L/S.F = \frac{2.2}{3.3} = \frac{2}{3}$$

$$\frac{4.8}{4.8+h} = \frac{2}{3}$$

$$h = 24$$

volume of smaller cone

$$\frac{1}{3} \times \frac{22}{7} \times 2.2 \times 2.4$$

$$= 12.169$$

Volume of large cone

$$\frac{1}{3} \times \frac{22}{7} \times 3.3 \times 3.3 (4.8 + 2.2)$$

$\therefore V \text{ of frustum}$

$$82.14 - 12.17 = 69.97 \text{ cm}^3$$

$$11. \quad (a) \text{ Volume} = \frac{2}{3} \pi r^3 + \frac{1}{3} \pi r^2 \times \frac{3}{2} r = 31.5\pi$$

$$4r^3 + 3r^3 = 31.5 \times 6$$

$$r = \sqrt[3]{\frac{31.5 \times 6}{7}}$$

$$= 3 \text{ cm}$$

$$(b) \text{ slant height of con} = \sqrt{4.5^2 + 3^2}$$

$$= 5.408 \text{ cm}$$

$$\text{Surface area} = 2\pi \times 3^2 + \pi \times 3 \times 5.408 = 107.5 \text{ cm}^2$$

$$(c) \text{ Height} = \frac{31.5}{4^2 \pi}$$

$$= 1.969 \text{ cm}$$

$$(d) \text{ Density} = \frac{144}{231.5\pi}$$

$$= 1.46 \text{ g/cm}^3$$

$$12. \quad \text{Volume of cube side } x \text{ cm} = (x \text{ cm})^3$$

$$\therefore x^3 \text{ cm}^3 = \frac{1280}{20} \text{ cm}^3$$

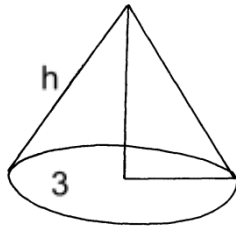
$$x = \sqrt[3]{\frac{1280}{20}}$$

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

$$= 4 \text{ cm}$$

13.

$$\frac{9}{3} = \frac{14 + h}{h}$$



$$9h = 42 + 3h$$

$$6h = 42$$

$$h = 7$$

$$\begin{aligned} \text{volume of the frustrum} &= \left(\frac{1}{3} \times \frac{22}{7} \times 9 \times 9 \times 21\right) \text{cm}^3 \\ &= \left(\frac{1}{3} \times \frac{22}{7} \times 3 \times 3 \times 7\right) \text{cm}^3 \\ &= 1782 - 66 = 1716 \text{cm}^3 \end{aligned}$$