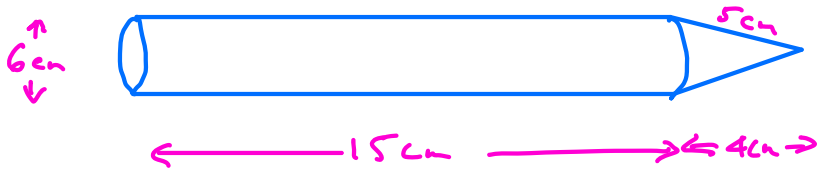
Cones and Compound Shapes

Ex



Find volume and surface area

Volume = cylinder + cone

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

$= \pi \times 3^2 \times 15 + \frac{1}{3}\pi \times 3^2 \times 4$

$= 135\pi + 12\pi$

$= 147\pi$

$= 462 \text{ cm}^3$

Surface Area = circular end + cylinder curved surface + cone curved surface

$= \pi r^2 + 2\pi r h_1 + \pi r l$

$= \pi \times 3^2 + 2\pi \times 3 \times 15 + \pi \times 3 \times 5$

$= 9\pi + 90\pi + 15\pi$

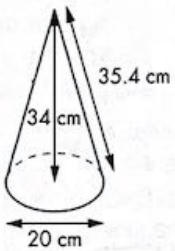
$= 114\pi$

$= 358 \text{ cm}^2$

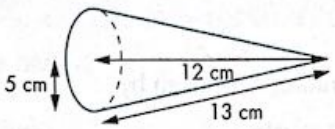
EXERCISE 4G

1 For each cone, calculate **i** its volume and **ii** its total surface area. Give your answers to 3 significant figures.

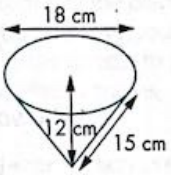
a



b



c



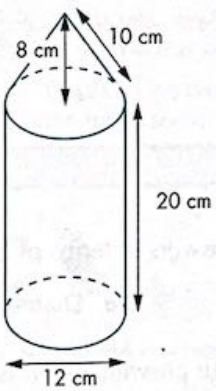
2 A solid cone, base radius 6 cm and vertical height 8 cm, is made of metal whose density is 3.1 g/cm^3. Find the mass of the cone.

3 Find the total surface area of a cone whose base radius is 3 cm and slant height is 5 cm. Give your answer in terms of π.

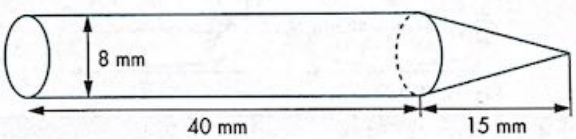
4 Find the total surface area of a cone whose base radius is 5 cm and slant height is 13 cm.

5 Calculate the volume of each of these shapes. Give your answers in terms of π.

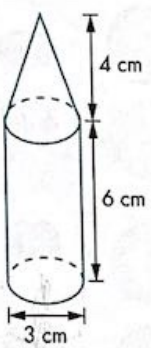
a



b



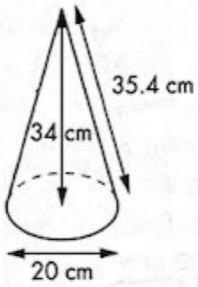
6 The model shown on the right is made from aluminium. What is the mass of the model, given that the density of aluminium is 2.7 g/cm^3?



7 A container in the shape of a cone, base radius 10 cm and vertical height 19 cm, is full of water. The water is poured into an empty cylinder of radius 15 cm. How high is the water in the cylinder?

1 For each cone, calculate **i** its volume and **ii** its total surface area. Give your answers to 3 significant figures.

a



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

$= \frac{1}{3}\pi \times 10^2 \times 34$

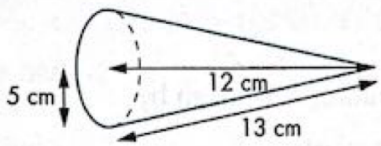
$= 3560\ cm^3$

$S.A. = \pi r l + \pi r^2$

$= \pi \times 10 \times 35.4 + \pi \times 10^2$

$= 1430\ cm^2$

b



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

$= \frac{1}{3}\pi \times 5^2 \times 12$

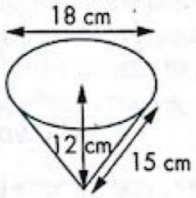
$= 314\ cm^3$

$S.A. = \pi r l + \pi r^2$

$= \pi \times 5 \times 13 + \pi \times 5^2$

$= 283\ cm^2$

c



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

$= \frac{1}{3} \times \pi \times 9^2 \times 12$

$= 1020\ cm^3$

$S.A. = \pi r l + \pi r^2$

$= \pi \times 9 \times 15 + \pi \times 9^2$

$= 679\ cm^2$

---

2 A solid cone, base radius 6 cm and vertical height 8 cm, is made of metal whose density is 3.1 g/cm^3. Find the mass of the cone.

$Vol = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 6^2 \times 8 = 301.59\ cm^3$

$Mass = Density \times Vol$

$= 3.1 \times 301.59$

$= 935\ g$ to 3 s.f.

---

3 Find the total surface area of a cone whose base radius is 3 cm and slant height is 5 cm. Give your answer in terms of π.

$S.A. = \pi r l + \pi r^2$

$= \pi \times 3 \times 5 + \pi \times 3^2 = 15\pi + 9\pi = 24\pi\ cm^2$

4 Find the total surface area of a cone whose base radius is 5 cm and slant height is 13 cm.

$S.A. = \pi r l + \pi r^2$

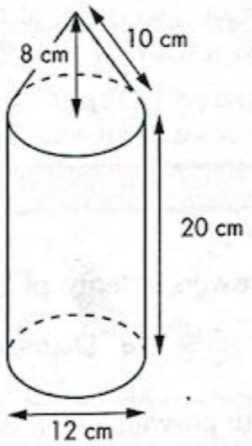
$= \pi \times 5 \times 13 + \pi \times 5^2$

$= 65\pi + 25\pi = 90\pi = 283\ cm^2$

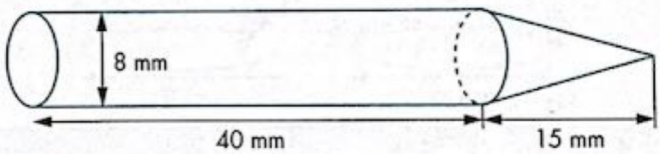
---

5 Calculate the volume of each of these shapes. Give your answers in terms of π.

a



b



Vol = cylinder + cone

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

a) $V = \pi \times 6^2 \times 20 + \frac{1}{3}\pi \times 6^2 \times 8$

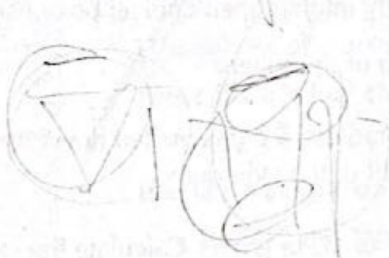
$= 720\pi + 96\pi = 816\pi\ cm^3$

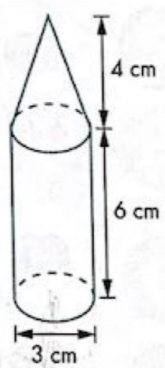
b) $V = \pi \times 4^2 \times 40 + \frac{1}{3}\pi \times 4^2 \times 15$

$= 640\pi + 80\pi = 720\pi\ mm^3$

---

6 The model shown on the right is made from aluminium. What is the mass of the model, given that the density of aluminium is 2.7 g/cm^3?





Vol = cylinder + cone

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

$= \pi \times 1.5^2 \times 6 + \frac{1}{3}\pi \times 1.5^2 \times 4$

$= \frac{33\pi}{2}\ cm^3$

Mass = Density × Vol

$= 2.7 \times \frac{33\pi}{2} = 140\ g$

7 A container in the shape of a cone, base radius 10 cm and vertical height 19 cm, is full of water. The water is poured into an empty cylinder of radius 15 cm. How high is the water in the cylinder?

Find volume of cone $r = 10cm$, $h = 19cm$

$V = \frac{1}{3}\pi r_1^2 h_1 = \frac{1}{3}\pi \times 10^2 \times 19 = \frac{1900\pi}{3}\ cm^3$

For cylinder $V = \pi r_2^2 h_2$

$\frac{V}{\pi r_2^2} = h_2$

$h_2 = \frac{\frac{1900\pi}{3}}{\pi \times 15^2}$

$h_2 = \frac{1900}{675} = 2.81\ cm$
