

Area and Volume Problems

Starter

1. **(Review of last lesson)** The volume of a cylinder is 260 cm^3 . Given that its height is 11 cm , calculate its diameter to 3 s.f..

Working: $V = 260, h = 11$
 Volume, $V = \pi r^2 h$: $260 = \pi \times r^2 \times 11$
 $260 = 11\pi r^2$
 $\frac{260}{11\pi} = r^2$
 $r = \sqrt{\frac{260}{11\pi}}$
 $r \approx 2.7429$
 The diameter of the cylinder is 5.49 cm (3 s.f.)

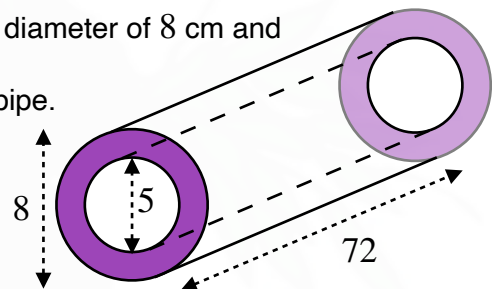
2. **(Review of last lesson)** A solid cylinder of radius 10 cm and length 14 cm is melted down and recast into a solid cube. Find the length of the side of the cube.

Working: $r = 10, h = 14$
 Volume, $V = \pi r^2 h$: $V = \pi \times 10^2 \times 14 = 1400\pi$
 The length of the side of the cube is $\sqrt[3]{1400\pi} = 16.4 \text{ cm}$.

- E.g. 1** A cylindrical metal pipe, of length 72 cm , has external diameter of 8 cm and internal diameter of 5 cm .

- (a) Calculate the volume of metal in the length of pipe.
 (b) Given that the density of the metal is 6 g/cm^3 , find the mass of the pipe.

Give your answers exactly and include units.



Working: (a) The volume of the metal can be found by taking the volume of the inner cylinder away from the outer cylinder.
 Outer: $r = 4, h = 72$ Inner: $r = 2.5, h = 72$
 Volume, $V = \pi r^2 h$: $V = \pi \times 4^2 \times 72 - \pi \times 2.5^2 \times 72$
 $= 702\pi$
 The volume of metal in the length of pipe is $702\pi \text{ cm}^3$.

(b) Density = $\frac{\text{Mass}}{\text{Volume}}$: $6 = \frac{\text{Mass}}{702\pi}$
 Mass = $6 \times 702\pi = 4212\pi$
 The mass of the pipe is 4212π grams.

- E.g. 2** Water flows through a circular pipe of internal diameter 3 cm at a speed of 16 cm/s . If the pipe is full, how many litres of water issue from the pipe in one minute?

Working: $r = 1.5, h = 16$
 Volume in 1 second, $V = \pi r^2 h$: $V = \pi \times 1.5^2 \times 16 = 36\pi$
 Volume in 1 minute: $36\pi \times 60 = 6785.8 \text{ cm}^3$
 Volume of water issue from the pipe in one minute is 6.79 litres.

Exercise

9-1 class textbook: p439 M13.6 Qu 1, 2, 4-8 (3 needs trigonometry)
A*-G class textbook: p392 M13.2 Qu 13-22
9-1 homework book: p149 M13.5/13.6 Qu 7-12
A*-G homework book: p110 M13.2 Qu 6-10

