



Composite shapes

Year 8 About 75 minutes Calculator allowed 46 marks

Date _____

A Do Now

Quick questions to start.

- A1** Needed today [1 mark]

A cylinder has radius 2 cm and height 10 cm. Write its volume in terms of π .

Answer

A2 Last lesson [1 mark]

A cylinder has radius 3 cm and height 4 cm. Write its curved surface area in terms of π .

Answer

- A3** Needed today [1 mark]

Write the area of a semicircle of radius 6 cm in terms of π .

Answer

A4 Year 7 [1 mark]

Work out the volume of a cuboid 5 cm by 4 cm by 3 cm.

Answer

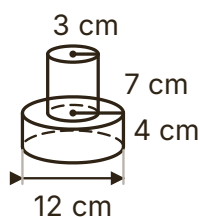
B Example, then your turn

Year 8

Your teacher works through each example with you. Then try the one beside it. Split the solid into shapes you know. Add their volumes, or take one away. Work in terms of π until the last step.

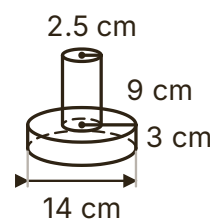
EXAMPLE 1

A cylinder of radius 3 cm and height 7 cm stands on a cylinder of diameter 12 cm and height 4 cm. Work out the volume of the solid, to 3 s.f.



Hint The bottom cylinder has radius 6 cm. Add the two volumes.

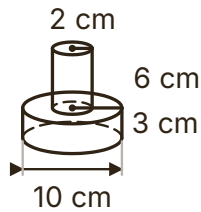
- B1** A cylinder of radius 2.5 cm and height 9 cm stands on a cylinder of diameter 14 cm and height 3 cm. Work out the volume of the solid, to 3 s.f. [2 marks]



Answer ... cm³

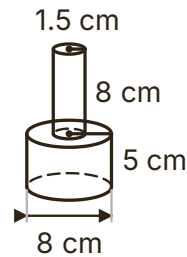
EXAMPLE 2

A cylinder of radius 2 cm and height 6 cm stands on a cylinder of diameter 10 cm and height 3 cm. Work out the total surface area, to 3 s.f.



Hint The small cylinder covers part of the top of the big one, and that same area is the small one's base. So: the whole big cylinder, plus the curved surface of the small one.

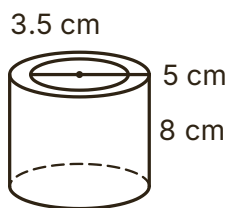
- B2** A cylinder of radius 1.5 cm and height 8 cm stands on a cylinder of diameter 8 cm and height 5 cm. Work out the total surface area, to 3 s.f. [3 marks]



Answer ... cm²

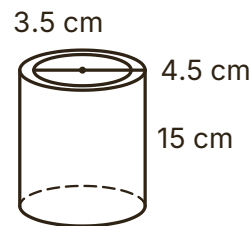
EXAMPLE 3

A tube is 8 cm long. Its outer radius is 5 cm and its inner radius is 3.5 cm. Work out the volume of the tube, to 3 s.f.



Hint Outer cylinder minus inner cylinder.

- B3** A tube is 15 cm long. Its outer radius is 4.5 cm and its inner radius is 3.5 cm. Work out the volume of the tube, to 3 s.f. [2 marks]

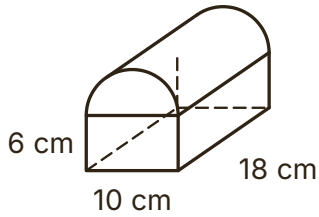


Not drawn accurately

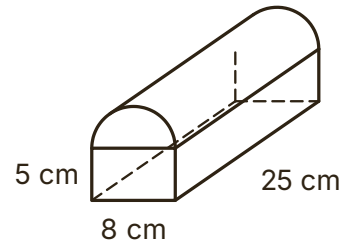
Answer ... cm³

EXAMPLE 4

A cuboid 10 cm wide, 18 cm long and 6 cm high has half a cylinder on top. Work out the volume, to 3 s.f.



Hint The half-cylinder has diameter 10 cm, so radius 5 cm, and length 18 cm.

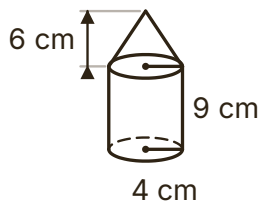
B4 A cuboid 8 cm wide, 25 cm long and 5 cm high has half a cylinder on top. Work out the volume, to 3 s.f. [3 marks]

Answer ... cm³

c Practice

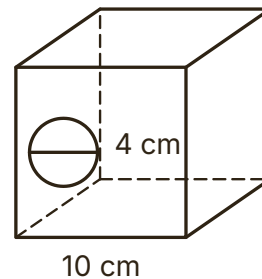
Year 8

- C1** A solid is a cylinder of radius 4 cm and height 9 cm with a cone of the same radius and height 6 cm on top. The volume of a cone is $\frac{1}{3}\pi r^2 h$. Work out the volume of the solid, to 3 s.f. [3 marks]



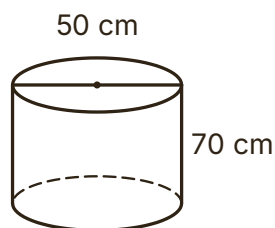
Answer ... cm³

- C2** A 10 cm cube has a hole of diameter 4 cm drilled straight through it, from front to back. Work out the volume that is left, to 3 s.f. [3 marks]



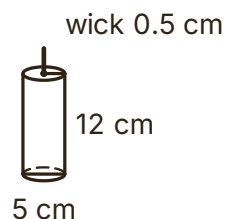
Answer ... cm³

- C3** A closed water tank is a cylinder. On the outside it is 50 cm across and 70 cm high. The walls, top and base are all 1 cm thick. How many litres does it hold, to 3 s.f.?



Answer ... litres

- C4** A candle is a cylinder of wax 5 cm across and 12 cm long. A wick 0.5 cm across runs through its centre for the whole length. Write the ratio volume of wick : volume of wax in the form 1 : n . [3 marks]



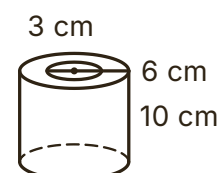
Answer 1 : ...

D Exam-style questions

GCSE Foundation

- D1** A tube is 10 cm long. Its outer radius is 6 cm and its inner radius is 3 cm. Lee says, "The inner radius is half the outer radius, so the tube is half the volume of a solid cylinder of radius 6 cm." [3 marks]

Show that Lee is wrong. What fraction is it?

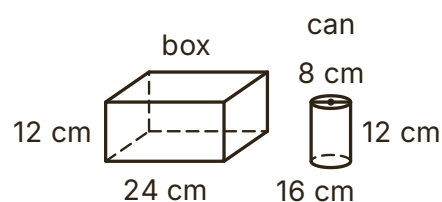


- D2** Cans of soup are 8 cm across and 12 cm tall. They stand upright in a box 24 cm long, 16 cm wide and 12 cm tall.

- (a) How many cans fit in the box? [1 mark]

Answer ... cans

- (b) What percentage of the box do the cans fill? Give your answer to 1 d.p. [3 marks]



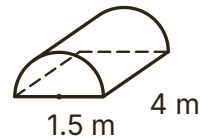
Answer ... %

Total for D2: 4 marks

D3 A garden shed is half a cylinder lying on its flat side. It has radius 1.5 m and length 4 m.

(a) Work out the volume of the shed, to 3 s.f.

[2 marks]



Answer ... m³

(b) Work out the total surface area of the shed, including the floor, to 3 s.f.

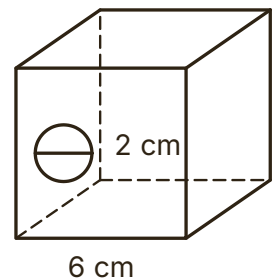
[3 marks]

Answer ... m²

Total for D3: 5 marks

D4 A 6 cm cube has a hole of diameter 2 cm drilled straight through it. Work out its total surface area, including the inside of the hole, to 3 s.f.

[4 marks]



Answer ... cm²

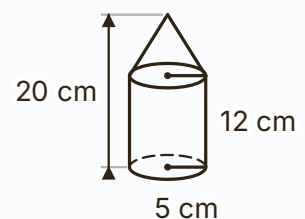
E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 A toy is a cylinder of radius 5 cm and height 12 cm with a cone on top. The toy is 20 cm tall altogether. The curved surface of a cone is πrl , where l is its slant height. Work out the total surface area of the toy, to 3 s.f.

[4 marks]



Answer ... cm²

Extension hints

Cover these with paper. Uncover one at a time.

- E1 Hint 1** The cone is $20 - 12 = 8$ cm tall. Its slant height is $\sqrt{5^2 + 8^2} = 9.43$ cm.
- Hint 2** The surface is the cone's curved surface, the cylinder's curved surface and one circle at the bottom.
- Hint 3** Cone $\pi \times 5 \times 9.43 = 148.2$, cylinder $2\pi \times 5 \times 12 = 377.0$, base $\pi \times 5^2 = 78.5$. Add them.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can split a composite solid into cylinders, cones and cuboids. ☐ ☐ ☐
- I can find the volume of a solid by adding parts or taking one away. ☐ ☐ ☐
- I can find a surface area without counting faces that are hidden. ☐ ☐ ☐
- I can solve problems about tubes, tanks and packing. ☐ ☐ ☐