

Exercise walk-through

Surface area and volume ■ E5.4

eXercise

You must be able to

- find the volume of a cylinder, cone, sphere and pyramid
- find the surface area of a cylinder and cone
- work with parts of solids (hemispheres)

Method — Volumes and surface areas

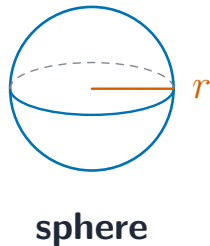
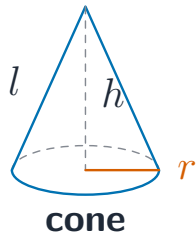
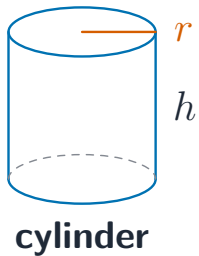
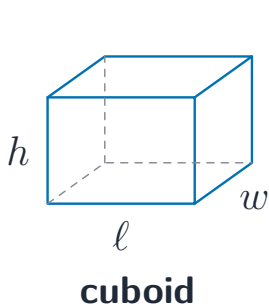
$$\text{cylinder: } V = \pi r^2 h, \quad SA = 2\pi rh + 2\pi r^2 \qquad \text{cone: } V = \frac{1}{3}\pi r^2 h$$

$$\text{sphere: } V = \frac{4}{3}\pi r^3, \quad SA = 4\pi r^2 \qquad \text{hemisphere: } V = \frac{2}{3}\pi r^3$$

- **Worked (cylinder $r = 5$, $h = 10$):** $V = \pi(25)(10) = 250\pi$; $SA = 100\pi + 50\pi = 150\pi \text{ cm}^2$.

Answer shapes: M1 a correct method, **A1** the correct answer.

Method — Volumes and surface areas



Common solids and their dimensions

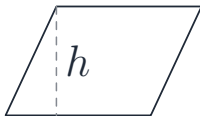
Method — Volumes and surface areas



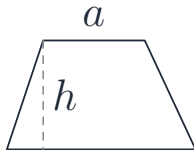
$$\ell \times w$$



$$\frac{1}{2} b h$$



$$b h$$



$$\frac{1}{2} (a + b) h$$

Face areas build up the surface area of a solid

Practice 2.1 ■ 1 mark

Find the volume of a cuboid 4 cm by 3 cm by 5 cm.

Solution 2.1

Worked steps

$$4 \times 3 \times 5 = 60 \text{ cm}^3 \text{ (B1).}$$

Practice 2.2 ■ 2 marks

Find the volume of a cylinder of radius 3 cm and height 10 cm, in terms of π .

Solution 2.2

Worked steps

$$\pi \times 3^2 \times 10 = 90\pi \text{ cm}^3 \quad \text{M1} \quad \text{A1} \quad \text{for } \pi r^2 h; \text{ for } 90\pi.$$

Practice 2.3 ■ 2 marks

Find the volume of a sphere of radius 3 cm, in terms of π .

Solution 2.3

Worked steps

$$\frac{4}{3}\pi \times 3^3 = \frac{4}{3}\pi \times 27 = 36\pi \text{ cm}^3 \quad \text{M1} \quad \text{A1} \quad \text{for } \frac{4}{3}\pi r^3; \text{ for } 36\pi.$$

Exam-style 3.1 ■ 2 marks

A cone has radius 6 cm and height 8 cm. Find its volume, in terms of π .

Solution 3.1

Worked steps

$$\frac{1}{3}\pi \times 6^2 \times 8 = \frac{1}{3}\pi \times 288 = 96\pi \text{ cm}^3 \quad \text{M1} \quad \text{A1} \quad \text{for } \frac{1}{3}\pi r^2 h; \text{ for } 96\pi.$$

Exam-style 3.2 ■ 3 marks

Find the total surface area of a cylinder of radius 4 cm and height 9 cm, in terms of π .

Solution 3.2

Method: Volumes and surface areas

Worked steps

$SA = 2\pi(4)(9) + 2\pi(4)^2 = 72\pi + 32\pi = 104\pi \text{ cm}^2$ **M1** **M1** **A1** *for the curved part; for $+2\pi r^2$; for 104π .*

Exam-style 3.3 ■ 2 marks

A solid hemisphere has radius 6 cm. Find its volume, in terms of π .

Solution 3.3

Method: Volumes and surface areas

Worked steps

$$\frac{2}{3}\pi \times 6^3 = \frac{2}{3}\pi \times 216 = 144\pi \text{ cm}^3 \quad \text{M1} \quad \text{A1} \quad \text{for } \frac{2}{3}\pi r^3; \text{ for } 144\pi.$$