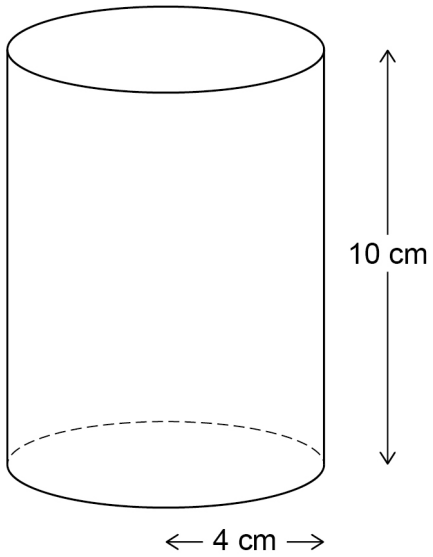
1 Here are two solids.

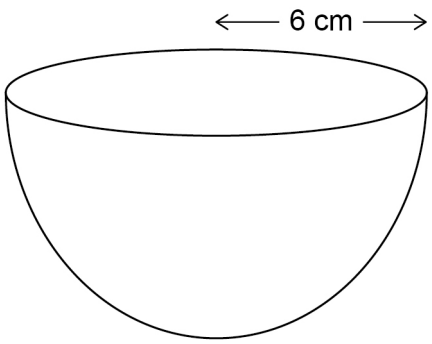
Cylinder

radius 4 cm height 10 cm



Hemisphere

radius 6 cm



volume of a hemisphere $= \frac{2}{3}\pi r^3$ where r is the radius

Which solid has the greater volume?

You **must** show your working.

[4 marks]

Volume of cylinder : $\pi \times 4^2 \times 10$

$= 160\pi$ (1)

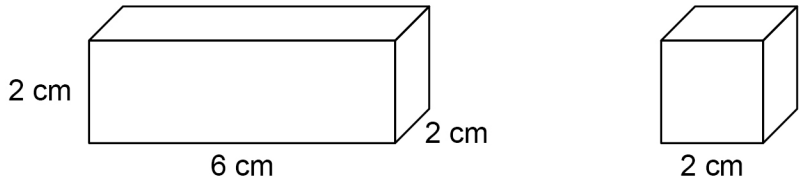
Volume of a hemisphere : $\frac{2}{3} \times \pi \times 6^3$ (1)

$= \frac{2}{3}(216) \times \pi$

$= 144\pi$ (1)

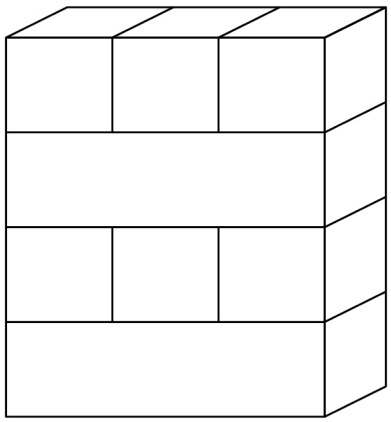
Answer cylinder (1)

2 Here is a small cuboid and a cube.



Small cuboids and cubes are stacked in layers to make larger cuboids.

Here is a cuboid made with four layers.



The pattern is continued to make a cuboid with volume 336 cm^3

How many **cubes** are used?

[3 marks]

Volume of 1 layer : $2 \times 6 \times 2 = 24$ (1)

$336 \div 24 = 14$ (1)

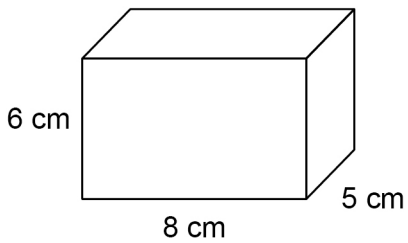
Layers of cubes : $14 \div 2 = 7$

1 layer = 3 cubes.

Total cubes: $7 \times 3 = 21$ (1)

Answer 21

3 Here is a cuboid.



Work out the volume.

[1 mark]

6 × 8 × 5 = 240 (1)

Answer 240 cm^3

4 A ball contains 5000 cm^3 of air.

More air is pumped into the ball at a rate of 160 cm^3 per second.

The ball is full of air when it becomes a sphere with radius 15 cm

Volume of a sphere $= \frac{4}{3}\pi r^3$ where r is the radius

Does it take **less than** 1 minute to fill the ball?

You **must** show your working.

[4 marks]

Volume of ball $= \frac{4}{3} \times \pi \times 15^3$ (1)

$= 14137 \ldots$

Air needed : $14137 - 5000 = 9137\ cm^3$ (1)

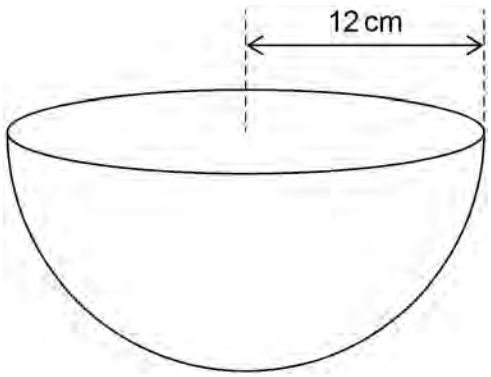
time taken $= \frac{9137\ cm^3}{160\ cm^3 s^{-1}} = 57.1\ s$ (1)

Yes. It takes only 57.1 seconds to fill the ball. (1)

5

Volume of a sphere = $\frac{4}{3}\pi r^3$

A bowl is a hemisphere with radius 12 cm



Water is poured into the bowl

at a rate of 325 cm^3 per second

for 8 seconds.

Does the water fill **more than** 70% of the bowl?

You **must** show your working.

[4 marks]

Volume of water = 325 × 8 = 2600 (1)

volume of hemisphere = $\frac{1}{2} \times \frac{4}{3} \times \pi \times 12^3$

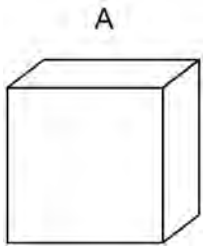
= 3620 (1)

$\frac{2600}{3620} \times 100\% = 71.8\%$ (1)

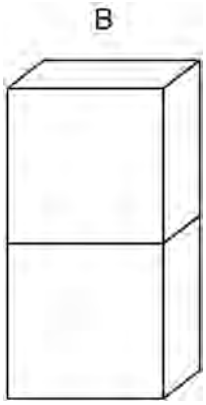
(1)

Yes. The water fills 71.8% of the bowl.

6 Here is cuboid A.



Cuboid B is made from **two** of cuboid A.



volume of A : volume of B = 1 : 2

Matthew says,

"surface area of A : surface area of B must be 1 : 2 because B is made of 2 of A."

Is Matthew correct?

Tick **one** box.

☐ Yes ☑ No ☐ Cannot tell

(1)

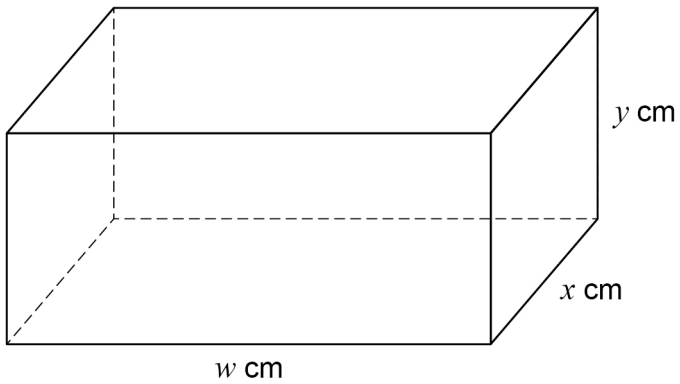
Give a reason for your answer.

[2 marks]

2 faces are hidden. (1)

7 (a) Here is a cuboid.

w, x and y are **different** whole numbers.



The total length of **all** the edges of the cuboid is 80 cm

The volume is **greater** than 200 cm^3

Work out one possible set of values for w, x and y.

[2 marks]

$4w + 4y + 4x = 80$

$4(w + x + y) = 80$

$w + x + y = 20$

$w \times x \times y > 200$

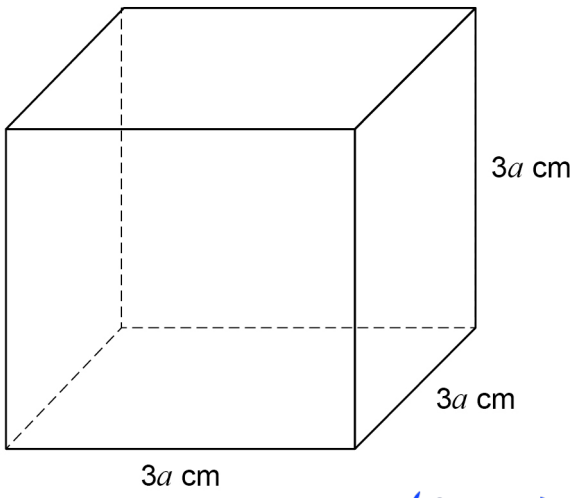
let $w = 8$, $x = 7$, $y = 5$

$8 + 7 + 5 = 20$, $8 \times 7 \times 5 = 280$

(2)

$w =$ 8 $x =$ 7 $y =$ 5

7 (b) Here is a solid cube.



$6(3a \times 3a)$

$6(9a^2)$

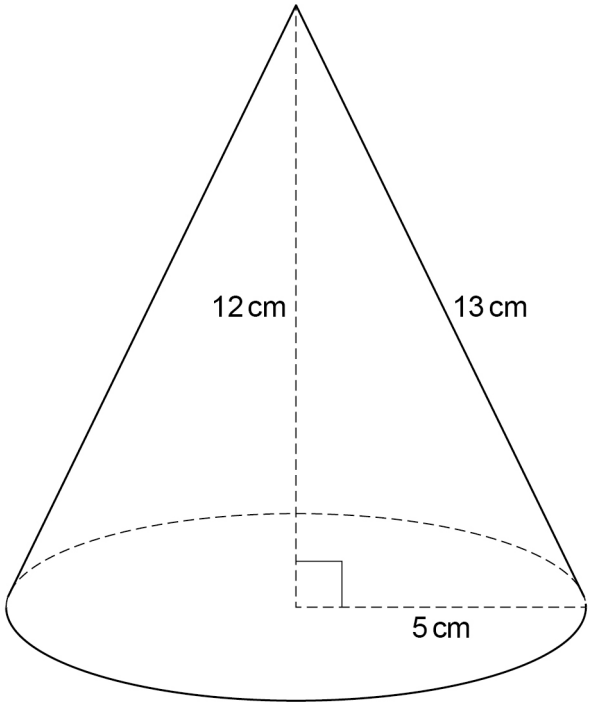
$54a^2$

Circle the expression for the **total** surface area in cm^2 **[1 mark]**

$36a$ $54a$ $36a^2$ $54a^2$

1

8 Here is a cone.



8 (a)

Curved surface area of a cone $= \pi rl$ where r is the radius and l is the slant height

Beth tries to work out the curved surface area in terms of π

Curved surface area of the cone $= \pi \times 5 \times 12$ $= 60\pi \text{ cm}^2$

What mistake has she made?

[1 mark]

The value of l should be 13 instead of 12 ✓ (1)

8 (b) Adam uses $\pi = 3$ to estimate the area of the **base** of the cone.

Work out his estimate.

[2 marks]

Area of the base of the cone = $\pi \times r^2$

$= 3 \times 5^2$

$= 3 \times 25$ ✓1

$= 75\ cm^2$ ✓1

Answer 75 cm^2

8 (c) Beth uses $\pi = 3.14$ to estimate the area of the **base** of the cone.

Is Beth's estimate more than or less than Adam's estimate?

Tick a box.

More than [✓] Less than [ ]

Give a reason for your answer.

[1 mark]

3.14 is larger than 3. ✓1