

Spheres and Cones

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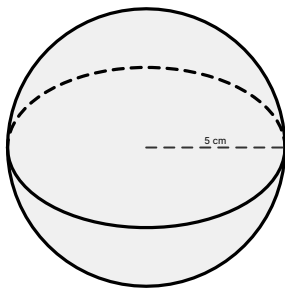
NAME _____

DATE _____

- 1 An empty cylindrical container has radius 8 cm and height 71 cm. 6  EITHER PAPER 2 MARKS
identical balls are stacked directly on top of one another inside it. Each ball is a sphere of radius 8 cm.

Will all 6 balls fit inside the container? Show working to support your answer.

- 2 Here is a solid sphere of radius 5 cm.  EITHER PAPER 2 MARKS

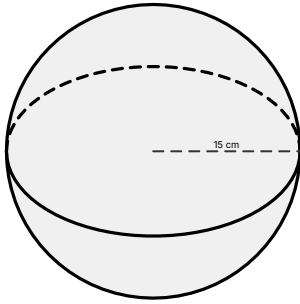


Surface area of a sphere = $4\pi r^2$

Find the surface area of the sphere. Give your answer in terms of π .

- 3 The diagram shows a solid sphere. It has a radius of 15 cm, so its diameter is 30 cm.

 EITHER PAPER 2 MARKS



The sphere is cut exactly in half, making a solid hemisphere.

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

Marcus works out the volume of the hemisphere, in terms of π . Here is his working:

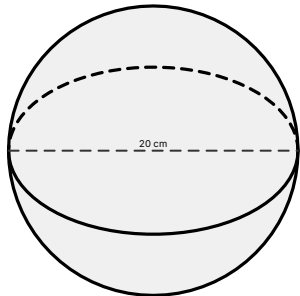
$$\text{Volume of hemisphere} = \frac{2}{3} \times \pi \times 30^2 = 600\pi \text{ cm}^3$$

Marcus has made two mistakes in this working.

Write down the two mistakes he has made.

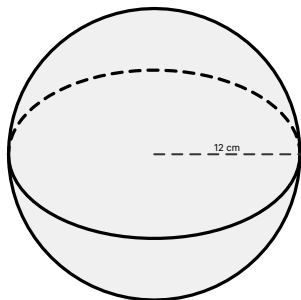
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- 4 The diagram shows a solid sphere. The diameter of the sphere is 20 cm.

 CALCULATOR 3 MARKS



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

Work out the volume of the sphere. Give your answer correct to 1 decimal place.



The ball is cut exactly in half through its centre, making two identical solid hemispheres.

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

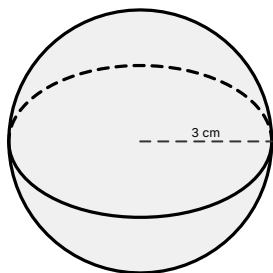
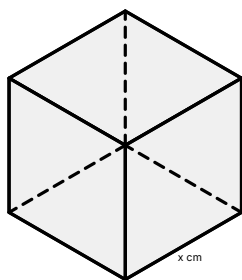
$$\text{Surface area of a sphere} = 4\pi r^2$$

(a) Calculate the volume of one of the hemispheres. Give your answer in terms of π .

(b) Calculate the total surface area of one of the hemispheres. Give your answer in terms of π .

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- 6 The diagram shows a cube with edges of length x cm, and a sphere of radius 3 cm. EITHER PAPER 4 MARKS

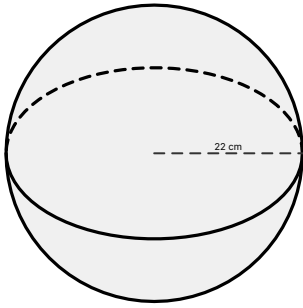


Surface area of a sphere $= 4\pi r^2$

The surface area of the cube is equal to the surface area of the sphere.

Show that $x = \sqrt{6\pi}$.

- 7 The diagram shows a sphere-shaped exercise ball. The ball has a radius of 22 cm. CALCULATOR 4 MARKS



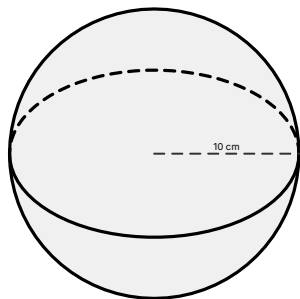
The ball already contains 15.6 litres of air. An electric pump then adds more air to the ball at a constant rate of 1.5 litres per minute.

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

$$1 \text{ litre} = 1000 \text{ cm}^3$$

Does it take less than 15 minutes to fill the ball completely? You must show your working.

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- 8 A bowl is a hemisphere with radius 10 cm. The diagram shows the full sphere it is exactly half of, cut through its centre. CALCULATOR 4 MARKS

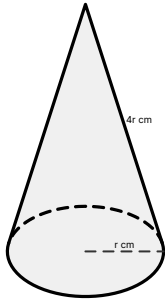
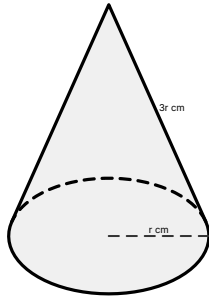


$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

Water is poured into the bowl at a rate of 46.4 cm³ per second for 18 seconds.

Does the water fill more than 45% of the bowl? You must show your working.

- 9 Two solid cones are shown before they are joined. Both cones have EITHER PAPER 3 MARKS
base radius r cm. One has slant height $3r$ cm and the other has slant height $4r$ cm.



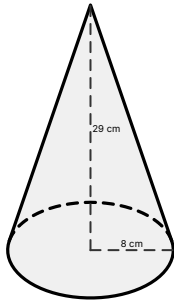
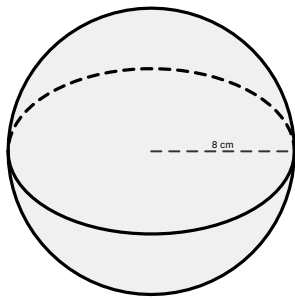
The two cones are then joined base to base to make one solid.

Curved surface area of a cone $= \pi r l$, where l is the slant height.

The total surface area of the solid is 323.68π cm².

Calculate the radius r .

- 10 A container in the shape of a sphere has radius 8 cm. A second container is a cone. The diagram shows the shape of the cone, which is used with its point downwards. The cone has base radius 8 cm and perpendicular height 29 cm. Both containers are to be filled with water. The diagrams are not drawn to scale.



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

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

Which container holds more? You must show your working.

1	No — the 6 balls need a stacked height of 96 cm and the container is 71 cm tall.	2	$100\pi \text{ cm}^2$
3	Mistake 1: used the diameter in place of the radius. Mistake 2: squared instead of cubing (used power 2, not power 3). (Either order.)	4	4188.8 cm^3
5	(a) $1152\pi \text{ cm}^3$ (b) $432\pi \text{ cm}^2$	6	$6x^2 = 36\pi$, so $x^2 = 6\pi$ and $x = \sqrt{6\pi}$.
7	No — it takes 19.3 minutes to fill, which is more than the 15 minute threshold.	8	No — the water fills 39.9% of the bowl, and the question asks about 45%.
9	6.8 cm	10	The sphere holds more: the sphere is $682\frac{2}{3}\pi \text{ cm}^3$ and the cone is $618\frac{2}{3}\pi \text{ cm}^3$.