1 Shape **S** is one quarter of a solid sphere, centre *O*.

Shape **S**

> **Volume of sphere** $= \dfrac{4}{3}\pi r^3$
>
> **Surface area of sphere** $= 4\pi r^2$
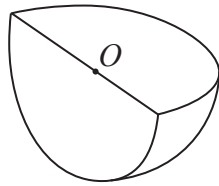
The volume of **S** is 576π cm³
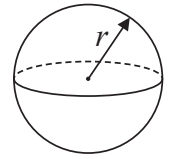
Find the surface area of **S**.
Give your answer correct to 3 significant figures.
You must show your working.

.... cm²

(Total for Question 1 is 5 marks)

2 The diagram shows a solid shape.
The shape is a cone on top of a hemisphere.

10 cm

6 cm

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

h

r

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

r
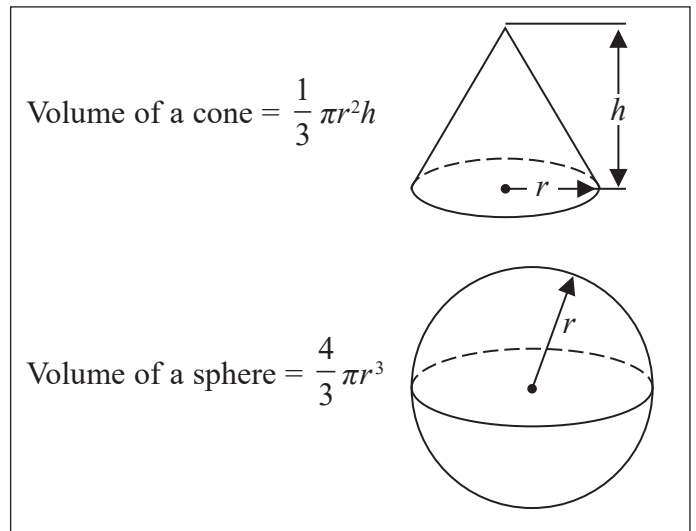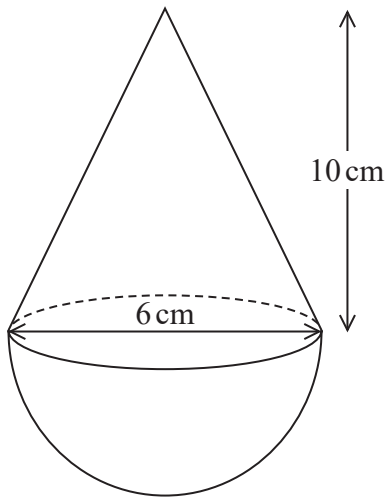
The height of the cone is 10 cm.
The base of the cone has a diameter of 6 cm.
The hemisphere has a diameter of 6 cm.

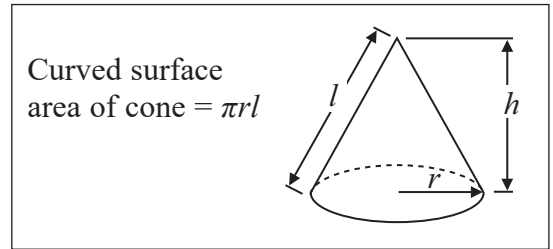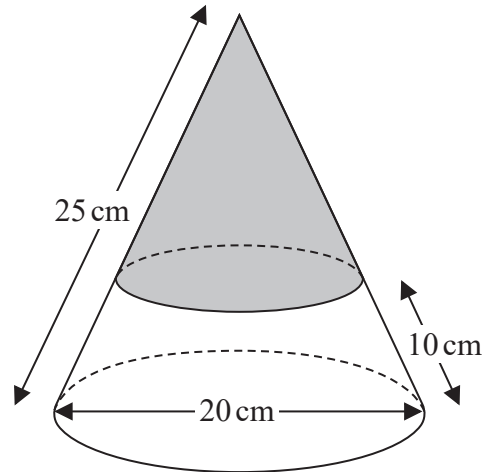The total volume of the shape is $k\pi\,\text{cm}^3$, where k is an integer.

Work out the value of k.

$k =$ ....

(Total for Question 2 is 4 marks)

3 The diagram represents a solid cone.

Curved surface area of cone = $\pi r l$

The cone has a base diameter of 20 cm and a slant height of 25 cm.

A circle is drawn around the surface of the cone at a slant height of 10 cm above the base.
The curved surface of the cone above the circle is painted grey.

Work out the area of the curved surface of the cone that is **not** painted grey.
Give your answer as a multiple of π
You must show all your working.

.... cm^2

(Total for Question 3 is 4 marks)

4   The diagram shows a cube with edges of length x cm and a sphere of radius 3 cm.

3 cm

r

Surface area of
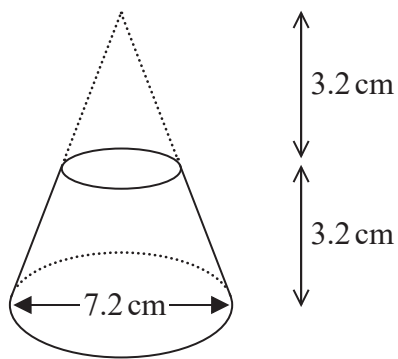sphere $= 4\pi r^2$
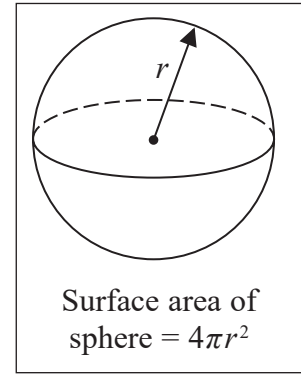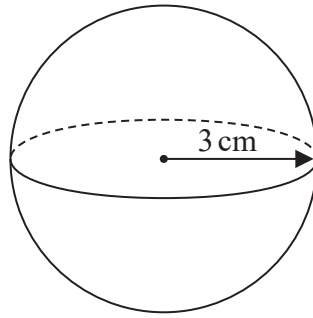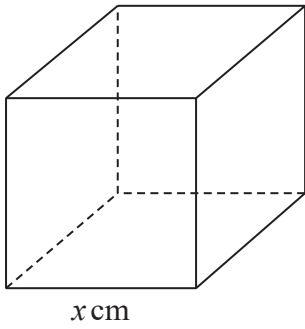
The surface area of the cube is equal to the surface area of the sphere.

Show that $x = \sqrt{k\pi}$ where k is an integer.

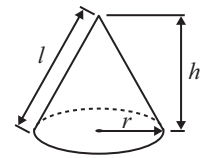**(Total for Question 4 is 4 marks)**

5 Here is a frustum of a cone.
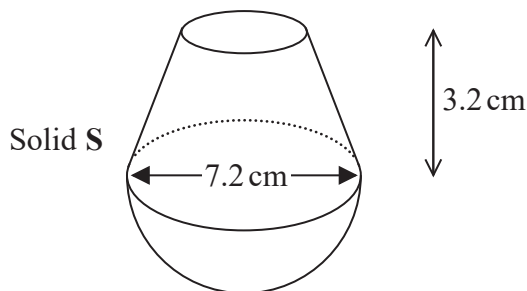
3.2 cm

3.2 cm

7.2 cm

Volume of sphere $= \dfrac{4}{3}\pi r^3$
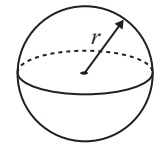
Volume of cone $= \dfrac{1}{3}\pi r^2 h$

The diagram shows that the frustum is made by removing a cone with height 3.2 cm from a solid cone with height 6.4 cm and base diameter 7.2 cm.

The frustum is joined to a solid hemisphere of diameter 7.2 cm to form the solid **S** shown below.

Solid **S**

3.2 cm

7.2 cm

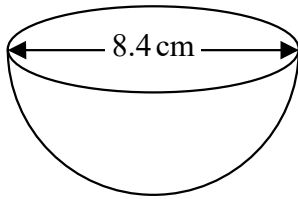The density of the frustum is 2.4 g/cm³
The density of the hemisphere is 4.8 g/cm³
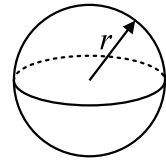
Calculate the average density of solid **S**.

....g/cm³

(Total for Question 5 is 5 marks)

6 The diagram shows a hemisphere with diameter 8.4 cm.

←— 8.4 cm —→

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

Work out the volume of the hemisphere.
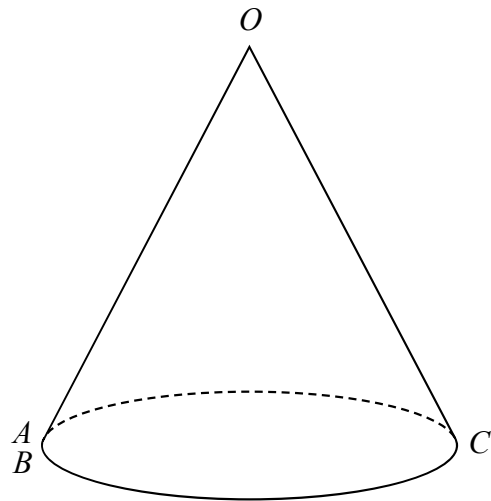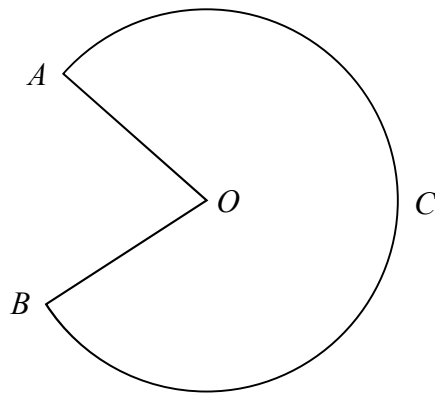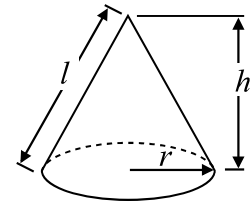Give your answer correct to 3 significant figures.

.... cm³

(Total for Question 6 is 2 marks)

7 The diagram shows a sector *OACB* of a circle with centre *O*.
The point *C* is the midpoint of the arc *AB*.

The diagram also shows a hollow cone with vertex *O*.
The cone is formed by joining *OA* and *OB*.

Volume of cone = $\dfrac{1}{3}\pi r^2 h$
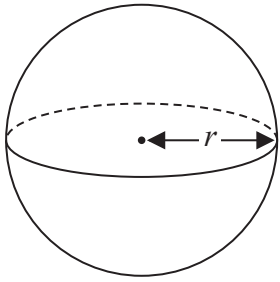
Curved surface area of cone = $\pi r l$

The cone has volume 56.8 cm³ and height 3.6 cm.

Calculate the size of angle *AOB* of sector *OACB*.
Give your answer correct to 3 significant figures.
You must show all your working.

(Total for Question 7 is 5 marks)

8 Here is a solid sphere and a solid cone.
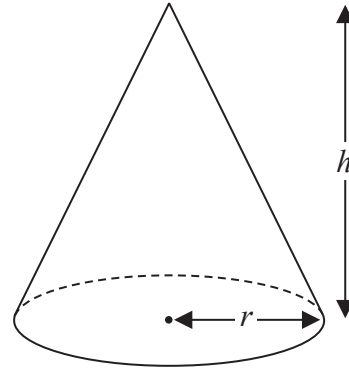
Volume of sphere $= \dfrac{4}{3}\pi r^3$ Volume of cone $= \dfrac{1}{3}\pi r^2 h$

All measurements are in cm.

The volume of the sphere is equal to the volume of the cone.

(a) Find $r:h$
   Give your answer in its simplest form.

....

(2)

Here is a different solid sphere and a different solid cone.
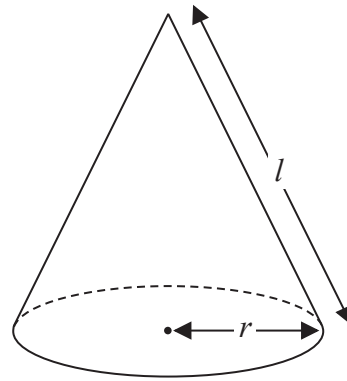
Surface area of sphere = $4\pi r^2$ Curved area of cone = $\pi r l$

All measurements are in cm.

The surface area of the sphere is equal to the **total** surface area of the cone.

(b) Find $r:h$

Give your answer in the form $1:\sqrt{n}$ where n is an integer.

(4)

(Total for Question 8 is 6 marks)

9 A solid cone is joined to a solid hemisphere to make the solid **T** shown below.

y cm

7 cm

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

Volume of cone $= \dfrac{1}{3}\pi r^2 h$

The diameter of the base of the cone is 7 cm.
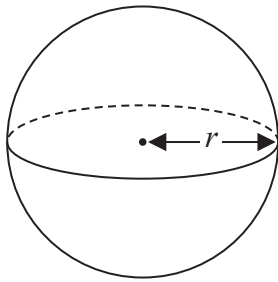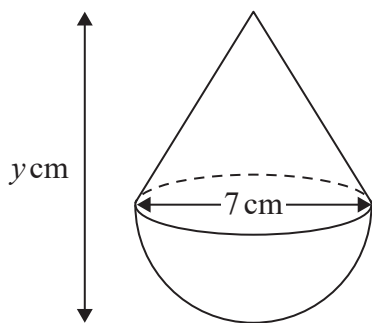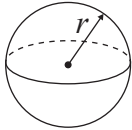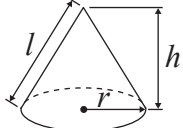The diameter of the hemisphere is 7 cm.

The total volume of **T** is 120π cm³
The total height of **T** is y cm.

(a) Calculate the value of y.
 Give your answer correct to 3 significant figures.

$y =$ ....

(4)

The diameter of the base of the cone and the diameter of the hemisphere are both increased by the same amount.
Assuming the total volume of **T** does not change,

(b) explain the effect this would have on your answer to part (a).

....

....

....

(1)

(Total for Question 9 is 5 marks)