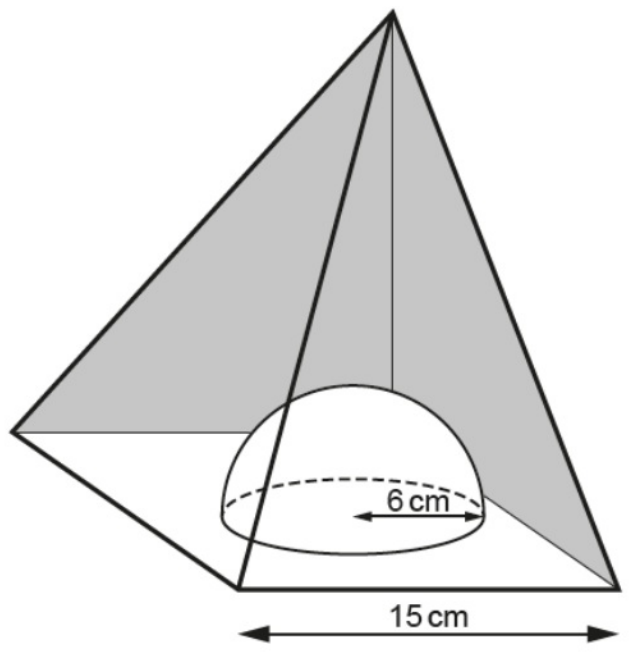


G35 - Volume and TSA of Compound Shapes

OCR

(b) An ornament is made from a solid glass square-based pyramid.
The base has side length 15 cm.
A hemisphere with radius 6 cm is cut out of the base of the pyramid.
This reduces the volume of glass contained in the ornament by 30%.

Created by W Neill



Calculate the perpendicular height of the pyramid.

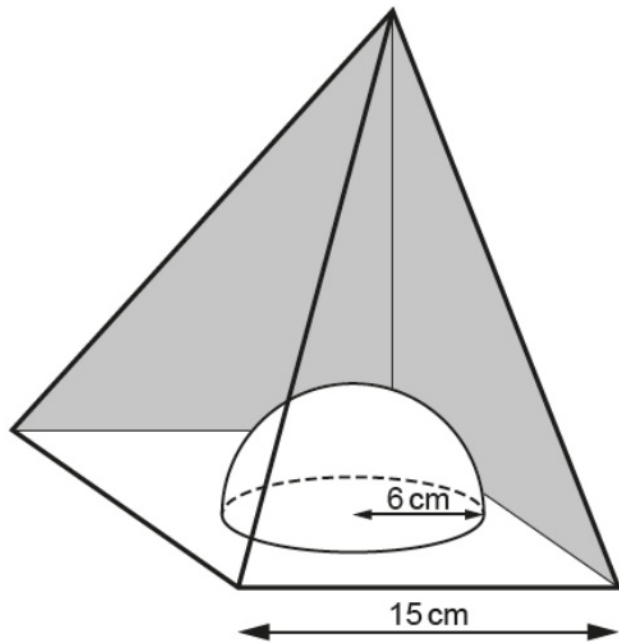
[The volume of a pyramid is $\frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$.

A hemisphere is half a sphere.]

(b) cm [5]

- (b) An ornament is made from a solid glass square-based pyramid.
 The base has side length 15 cm.
 A hemisphere with radius 6 cm is cut out of the base of the pyramid.
 This reduces the volume of glass contained in the ornament by 30%.

Created by W Neill



Calculate the perpendicular height of the pyramid.

[The volume of a pyramid is $\frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$.

A hemisphere is half a sphere.]

$$\text{Sphere} = 288\pi$$

$$\text{hemisphere} = 144\pi = 30\%$$

$$\text{Full shape hemisphere} = 144\pi = 30\%$$

$$48\pi = 10\%$$

$$480\pi = 100\%$$

$$75h = 480\pi$$

$$h = \frac{480\pi}{75} =$$

Full pyramid

$$\frac{1}{3} \times 15 \times 15 \times h = 480\pi$$

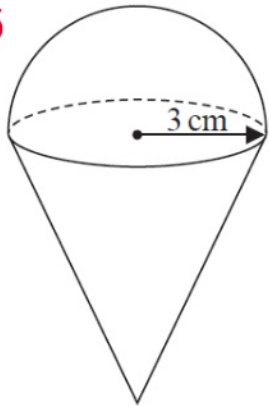
(b) 20.106 ✓ cm [5]

Edexcel

19 The diagram shows a solid made by joining a solid hemisphere to a solid circular cone.

The centre of the plane face of the cone coincides with the centre of the plane face of the hemisphere.

635



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

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

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

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

The radius of the hemisphere is 3 cm.

The radius of the base of the cone is 3 cm.

The volume of the solid is $30\pi \text{ cm}^3$

Work out the total surface area of the solid.

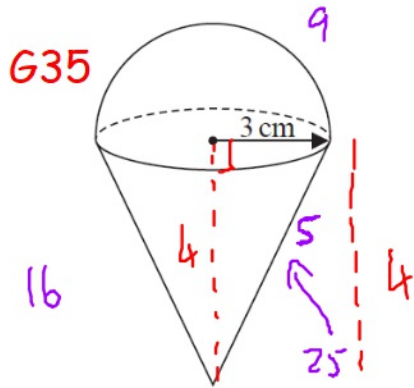
Give your answer as a multiple of π .

..... cm^2

(Total for Question 19 is 5 marks)

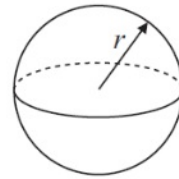
19 The diagram shows a solid made by joining a solid hemisphere to a solid circular cone.

The centre of the plane face of the cone coincides with the centre of the plane face of the hemisphere.



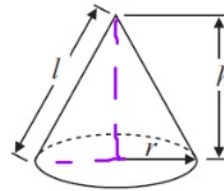
Surface area of sphere = $4\pi r^2$

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



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

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



The radius of the hemisphere is 3 cm.

The radius of the base of the cone is 3 cm.

The volume of the solid is $30\pi \text{ cm}^3$

Work out the total surface area of the solid.

Give your answer as a multiple of π .

$$\begin{aligned} \text{SA of hemi-s} &= 2\pi r^2 = 2\pi 3^2 \\ &= 18\pi \text{ cm}^2 \\ \text{CSA of } \pi r l &= \pi(3)5 \\ &= 15\pi \text{ cm}^2 \end{aligned}$$

(Total for Question 19 is 5 marks)

$$\begin{aligned} \text{hemi-s} &= \frac{2}{3}\pi r^3 \\ &= \frac{2}{3}\pi 3^3 \\ &= \frac{2}{3}\pi 27 = 18\pi \end{aligned}$$

$$\begin{aligned} \text{Volume of cone} &= \\ 30\pi - 18\pi &= 12\pi \end{aligned}$$

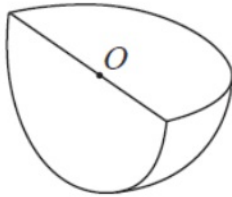
$$\frac{1}{3}\pi r^2 h = 12\pi$$

$$\begin{aligned} \frac{1}{3}(9)h &= 12 \\ 3h &= 12 \\ h &= 4 \end{aligned}$$

$$\begin{aligned} \text{SA} &= 18\pi + 15\pi \\ &= 33\pi \text{ cm}^2 \end{aligned}$$

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

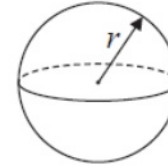
G34
G35



Shape S

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

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



The volume of S is $576\pi \text{ cm}^3$

Find the surface area of S.

Give your answer correct to 3 significant figures.

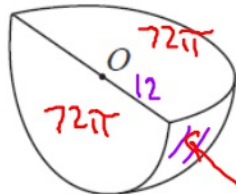
You must show your working.

..... cm^2

(Total for Question 19 is 5 marks)

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

G34
G35

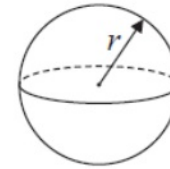


Shape S

$\frac{1}{4}$ of sphere

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

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



$576\pi \times 4$

The volume of S is $576\pi \text{ cm}^3$

Find the surface area of S.

Give your answer correct to 3 significant figures.

You must show your working.

$$\begin{aligned}
 SA = \text{full sphere} &= 4\pi r^2 \\
 &= 4\pi 12^2 \div 4 \\
 &= 12^2 \pi = 144\pi \\
 \frac{1}{2} \text{ Circle} &= \frac{r^2 \times \pi}{2} = \frac{144\pi}{2} = 72\pi \times 2 \\
 &= 144\pi
 \end{aligned}$$

full sphere = $\frac{4}{3}\pi r^3 = 2304\pi$

$\frac{4}{3}r^3 = 2304$

$4r^3 = 2304 \times 3$

$4r^3 = 6912$

$r^3 = 1728 \div 4$

$r = \sqrt[3]{1728}$

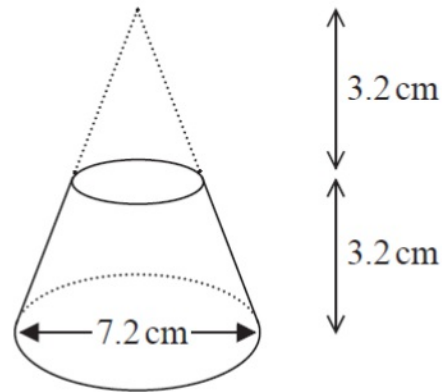
$r = 12$

ans
144π
$+ 144\pi$
$= 288\pi$
$= 904.77$
<u>905</u> cm^2

(Total for Question 19 is 5 marks)

20 Here is a frustum of a cone.

G35
R24

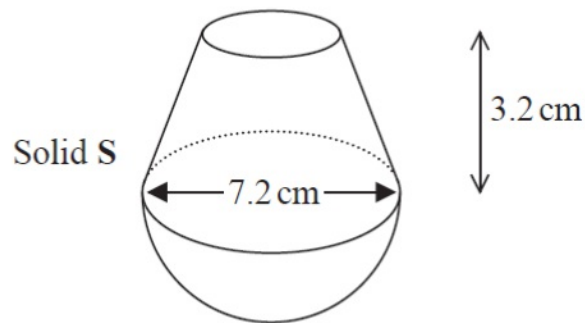


Volume of sphere = $\frac{4}{3}\pi r^3$

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

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.



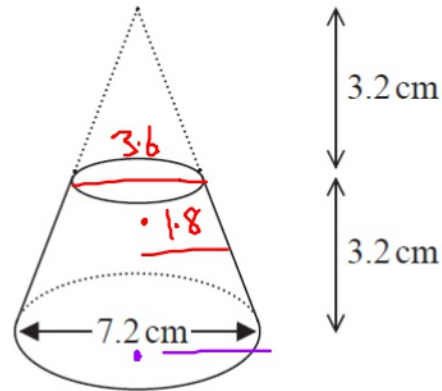
The density of the frustum is 2.4 g/cm³
 The density of the hemisphere is 4.8 g/cm³
 Calculate the average density of solid S.

..... g/cm³

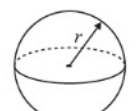
(Total for Question 20 is 5 marks)

20 Here is a frustum of a cone.


G35
R24




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



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



Volume of frustum



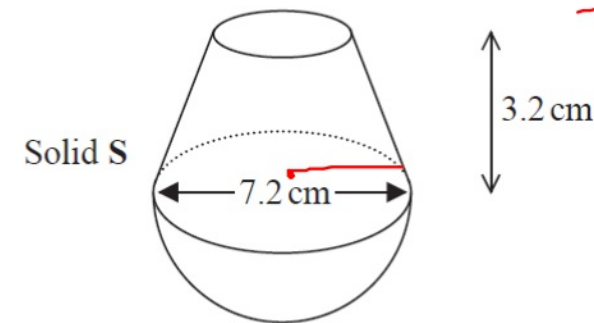
$$= \frac{1}{3}\pi r^2 h$$

$$= \frac{1}{3}\pi (3.6^2)(6.4)$$

$$= 86.8587 \text{ cm}^3$$

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.



Volume of hemi-s

$$\frac{\frac{4}{3}\pi r^3}{2}$$

Sub $\rightarrow \Delta = \frac{1}{3}\pi r^2 h$

$$= \frac{1}{3}\pi (1.8^2) 3.2$$

$$= 76.0014 \text{ cm}^3$$

$$= 97.716 \text{ cm}^3$$

..... g/cm³

(Total for Question 20 is 5 marks)

AQA

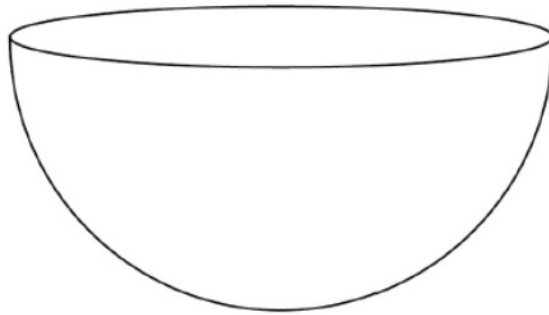
27

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

Video created by W Neill

G34

G35 A container is a hemisphere of radius 30 cm



Sand fills the container at a rate of 4000 cm^3 per minute.

Does it take **less than** a quarter of an hour to fill the container?

You **must** show your working.

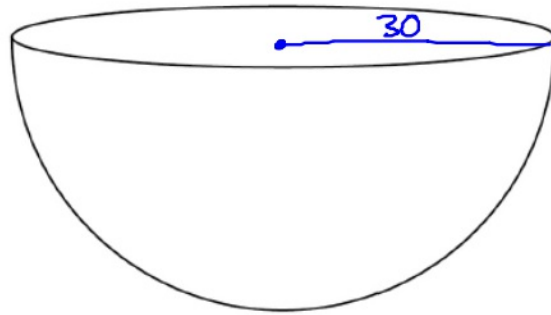
[3 marks]

Answer _____

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

G34

G35 A container is a hemisphere of radius 30 cm



Sand fills the container at a rate of 4000 cm^3 per minute.

Does it take **less than** a quarter of an hour to fill the container?

You **must** show your working.

Yes it does take less [3 marks] 14.13 min

than $\frac{1}{4}$ hr (15 min)

$$14.13 < 15 \checkmark$$

Answer _____

$$\text{Volume full} = \frac{4}{3} \times \pi \times 30^3$$

$$= 36000\pi$$

$$\frac{1}{2} \text{ sphere} = \div 2$$

$$= 56548.66 \text{ cm}^3$$

$$56548 \dots \div 4000 = \text{min}$$

28

Volume of cone = $\frac{1}{3}\pi r^2 h$ where r is the radius and h is the perpendicular height. Video created by W Neill

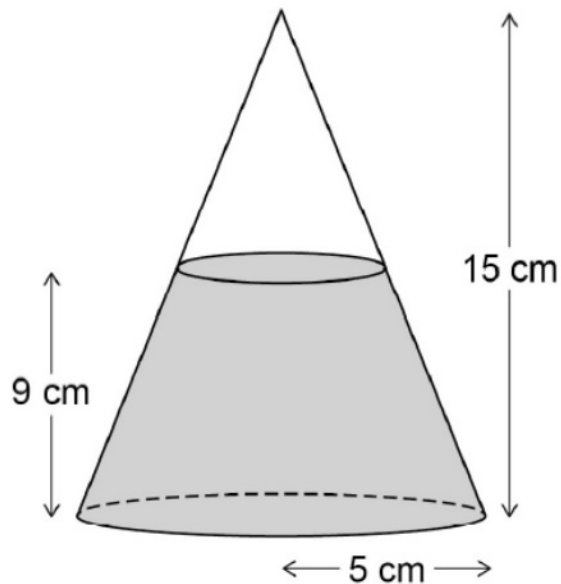
G35

A cone has a

horizontal base of radius 5 cm

height of 15 cm

The cone contains water to a depth of 9 cm



Work out the volume of the water, in cm^3

[4 marks]

Give your answer in terms of π .

Answer _____ cm^3

28

Volume of cone = $\frac{1}{3}\pi r^2 h$ where r is the radius and h is the perpendicular height. Video created by W Neill

G35

A cone has a
horizontal base of radius 5 cm
height of 15 cm

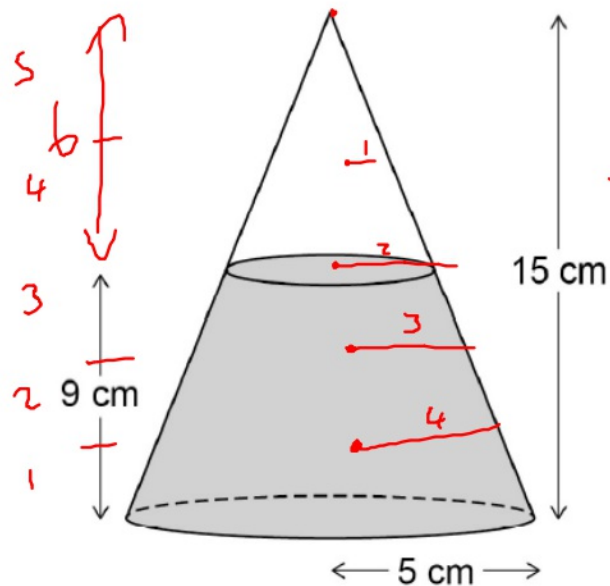
The cone contains water to a depth of 9 cm

full cone $\frac{1}{3}\pi 5^2 15$
 $\frac{1}{3}\pi (25)(15)$
 $\pi (25)(5) = 125\pi$

Work out the volume of the water, in cm^3

[4 marks]

Give your answer in terms of π .



Top Cone $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi 2^2 6$
 $\frac{1}{3}\pi (4) 6$
 $\pi 4(2) = 8\pi$

Water left = $125\pi - 8\pi$

Answer 117π cm^3 ✓

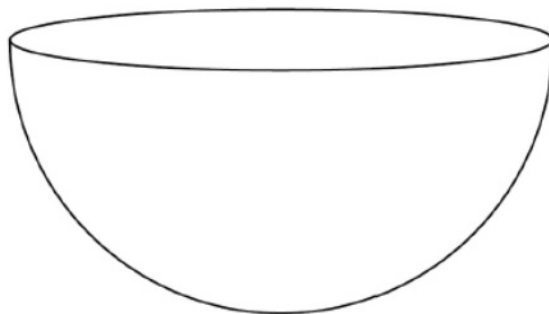
10

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

Video created by W Neill

G34

G35 A container is a hemisphere of radius 30 cm



Sand fills the container at a rate of 4000 cm^3 per minute.

Does it take **less than** a quarter of an hour to fill the container?

You **must** show your working.

[3 marks]

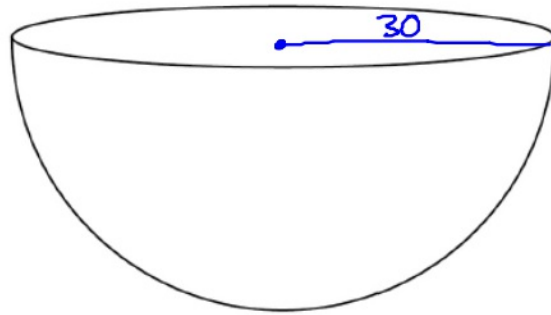
Answer _____

10

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

G34

G35 A container is a hemisphere of radius 30 cm



Sand fills the container at a rate of 4000 cm^3 per minute.

Does it take **less than** a quarter of an hour to fill the container?

You **must** show your working.

Yes it does take less [3 marks] 14.13 min

than $\frac{1}{4}$ hr (15 min)

$$14.13 < 15 \checkmark$$

Answer _____

$$\text{Volume full} = \frac{4}{3} \times \pi \times 30^3$$

$$= 36000\pi$$

$$\frac{1}{2} \text{ sphere} = \div 2$$

$$= 56548.66 \text{ cm}^3$$

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