IGCSE · Cambridge (CIE) · Maths

3 hours 35 questions

Calculator Questions

Volume & Surface Area

Volume / Problem Solving with Volumes / Surface Area

Easy (4 questions)	/10
Medium (7 questions)	/31
Hard (15 questions)	/87
Very Hard (9 questions)	/61
Total Marks	**/189**

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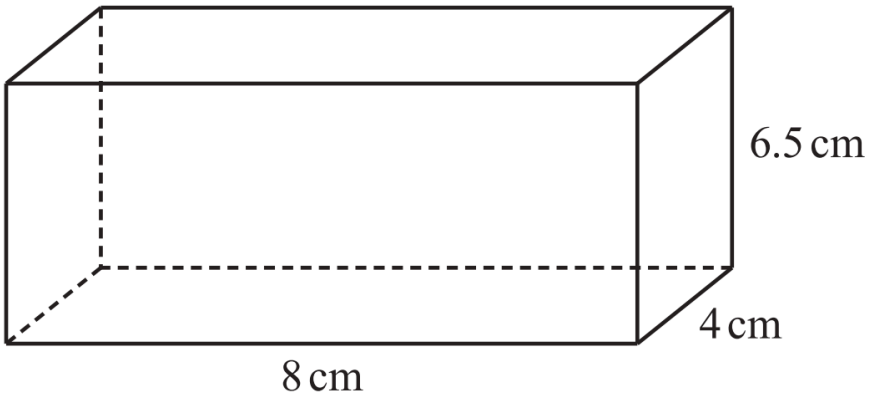
Easy Questions

1



NOT TO SCALE

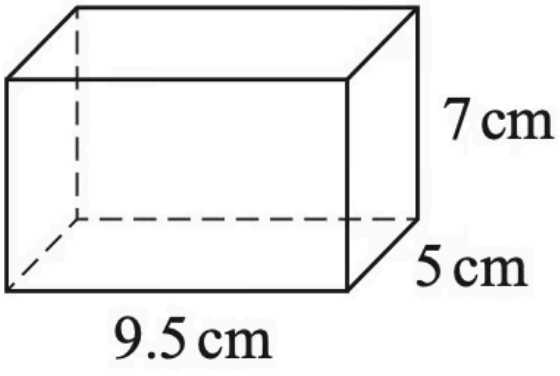
The diagram shows a cuboid.

Calculate the volume of the cuboid.

..... cm^3

(1 mark)

2 A cuboid measures 5cm by 7cm by 9.5cm.



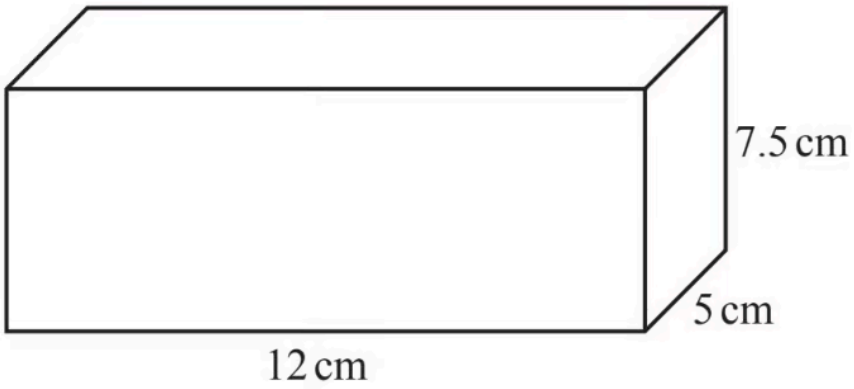
NOT TO SCALE

Work out the surface area of this cuboid.

..... cm^2

(3 marks)

3



NOT TO SCALE

Calculate the total surface area of the cuboid.

.....cm^2

(3 marks)

4 Here is a cuboid.

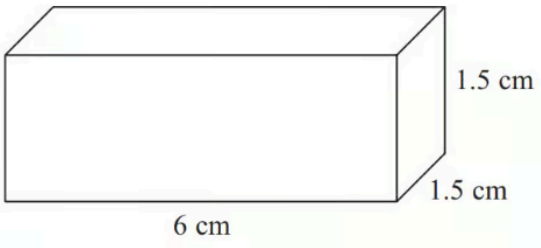


Diagram **NOT** accurately drawn

The cuboid is 6 cm by 1.5 cm by 1.5 cm.

Work out the total surface area of the cuboid.

(3 marks)

Medium Questions

1 (a) A solid metal cuboid has a volume of $600cm^3$.

The base of the cuboid is 10 cm by 12 cm.
Calculate the height of the cuboid.

..... cm

(2 marks)

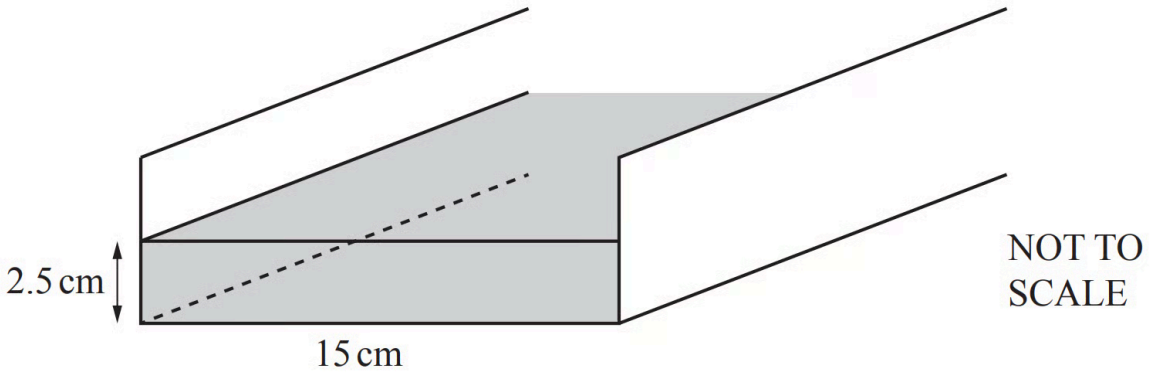
(b) The solid metal cuboid is melted and made into 1120 spheres, each with radius 0.45cm.

Find the volume of metal **not** used in making these spheres.

..... cm^3

(2 marks)

2



Water flows at a speed of 20 cm/s along a rectangular channel into a lake.
The width of the channel is 15 cm.
The depth of the water is 2.5 cm.

Calculate the amount of water that flows from the channel into the lake in 1 hour.
Give your answer in litres.

..... litres

(4 marks)

3 Water from Manjeet's shower flows at a rate of 12 litres per minute.
The water from the shower flows into a tank that is a cuboid of length 90 cm and width 75 cm.

Calculate the increase in the level of water in the tank when the shower is used for 7 minutes.

..... cm

(3 marks)

4 i) Calculate the external curved surface area of a cylinder with radius 8 m and height 19 m.

..... m^2 [2]

ii) This surface is painted at a cost of $0.85 per square metre.

Calculate the cost of painting this surface.

$ ..... [2]

(4 marks)

5 The lake behind a dam has an area of 55 hectares.
When the gates in the dam are open, water flows out at a rate of 75 000 litres per second.

i) Show that 90 million litres of water flows out in 20 minutes.

[1]

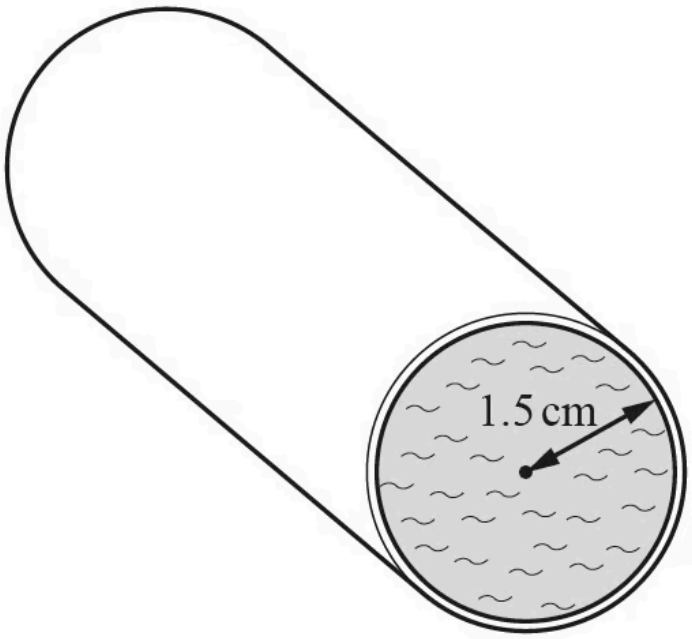
ii) Beneath the surface, the lake has vertical sides.

Calculate the drop in the water level of the lake when the gates are open for 20 minutes.
Give your answer in centimetres.
[1 hectare = 10^4 m^2, 1000 litres = 1 m^3]

..... cm [3]

(4 marks)

6



NOT TO SCALE

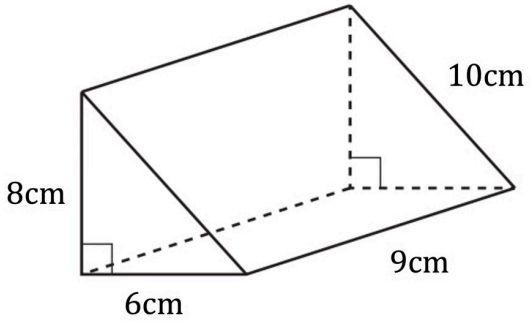
Water flows through a cylindrical pipe at a speed of 8 cm/s.
The radius of the circular cross-section is 1.5 cm and the pipe is always completely full of water.

Calculate the amount of water that flows through the pipe in 1 hour.
Give your answer in litres.

..... litres

(4 marks)

7 (a)



Write down the name of the 3D shape in the diagram.

(1 mark)

(b) Calculate the surface area of the shape.

Include units in your answer.

(4 marks)

(c) Work out the volume of the shape.

Include units in your answer.

(3 marks)

Hard Questions

1 The cross-section of a prism is an equilateral triangle of side 6cm.
The length of the prism is 20 cm.

Calculate the total surface area of the prism.

..... cm^2

(4 marks)

2 A pipe is completely full of water.
Water flows through the pipe at a speed of 1.2 m/s into a tank. The cross-section of the pipe has an area of 6 cm^2.

Calculate the number of litres of water flowing into the tank in 1 hour.

..... litres

(4 marks)

3 A cone with height 14.8 cm has volume 275 cm^3.

Calculate the radius of the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm

(3 marks)

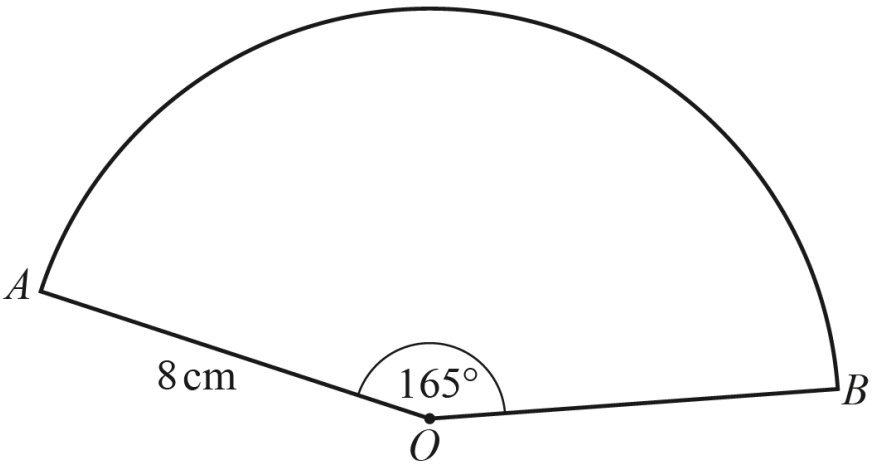
4 A pipe is full of water.
The cross-section of the pipe is a circle, radius 2.6 cm.
Water flows through the pipe into a tank at a speed of 12 centimetres per second.

Calculate the number of litres that flow into the tank in one hour.

..... litres

(3 marks)

5 (a)



NOT TO SCALE

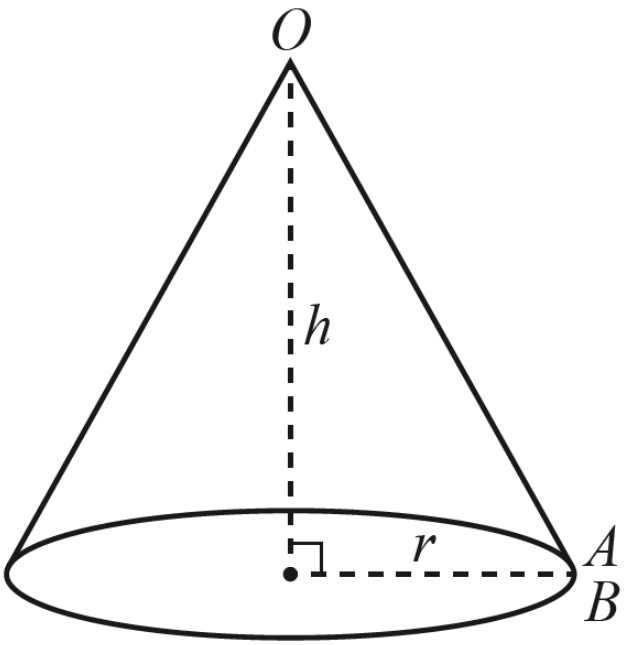
The diagram shows a sector of a circle with centre O, radius 8 cm and sector angle 165°.
The surface area of a sphere is the same as the area of the sector.

Calculate the radius of the sphere.
[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

..... cm

(4 marks)

(b)



NOT TO SCALE

A cone is made from the sector by joining OA to OB.

i) Calculate the radius, r, of the cone.

$r =$ ..... cm [2]

ii) Calculate the volume of the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h.$]

..... cm^3 [4]

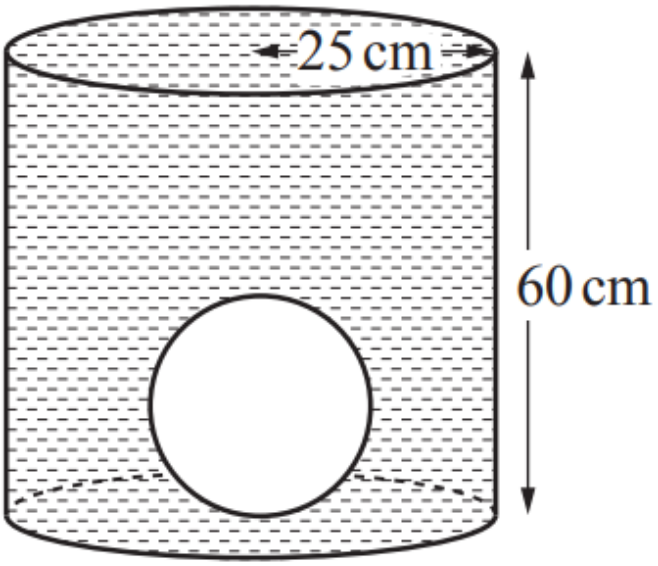
(6 marks)

6 (a) Show that the volume of a metal sphere of radius 15 cm is 14 140 cm^3, correct to 4 significant figures.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

(2 marks)

(b) i) The sphere is placed inside an empty cylindrical tank of radius 25 cm and height 60 cm. The tank is filled with water.

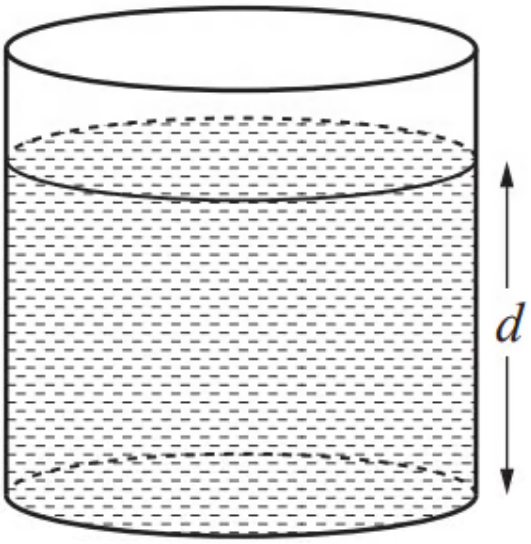


NOT TO SCALE

Calculate the volume of water needed to fill the tank.

..... cm^3 [3]

ii) The sphere is removed from the tank.



NOT TO SCALE

Calculate the depth, d, of water in the tank.

d = ... cm [2]

(5 marks)

7 A solid metal sphere with radius 6 cm is melted down and all of the metal is used to make a solid cone with radius 8 cm and height h cm.

i) Show that $h = 13.5$.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

[2]

ii) Calculate the slant height of the cone.

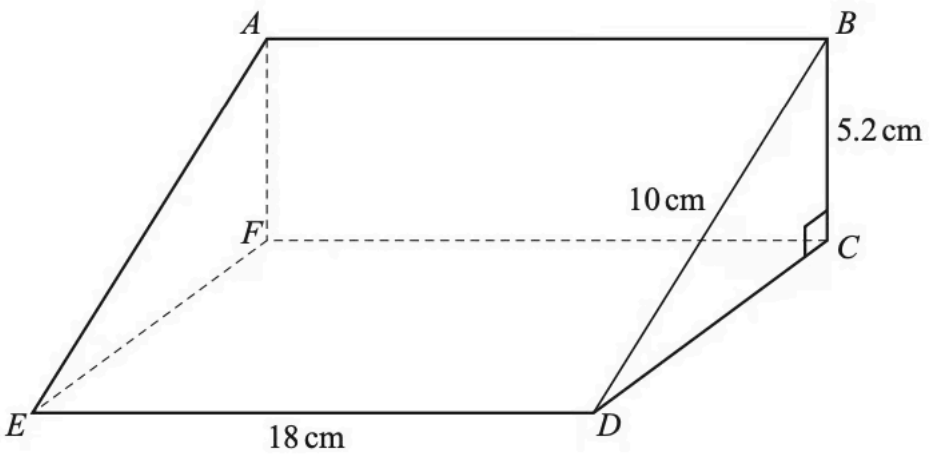
..... cm [2]

iii) Calculate the curved surface area of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

..... cm^2 [1]

(5 marks)

8



NOT TO SCALE

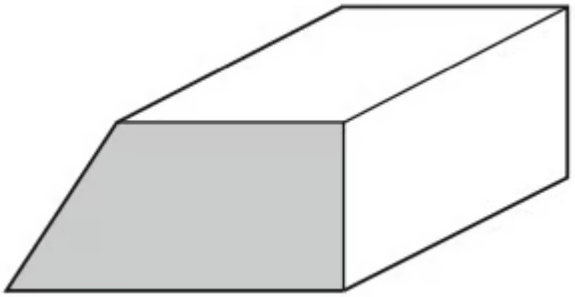
The diagram shows a prism *ABCDEF*.
The cross-section is a right-angled triangle *BCD*.
BD = 10 cm, *BC* = 5.2 cm and *ED* = 18 cm.

Work out the volume of the prism.

..... cm^3

(6 marks)

9



The diagram shows a solid metal prism.
The volume of the prism is 2187 cm^3.
The larger prism is melted down into a sphere.

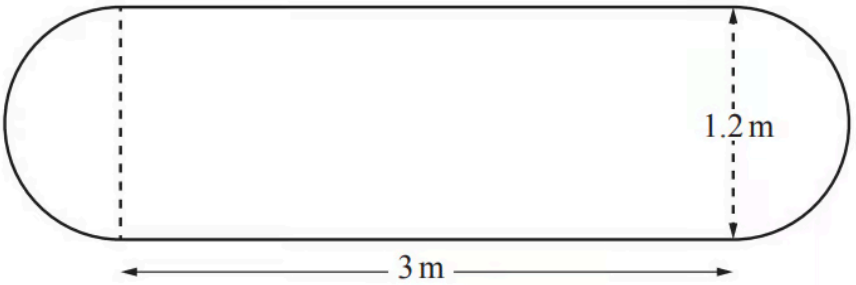
Calculate the radius of the sphere.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm

(3 marks)

10 (a)



NOT TO SCALE

The diagram shows the surface of a garden pond, made from a rectangle and two semicircles.
The rectangle measures 3 m by 1.2 m.

Calculate the area of this surface.

.....m^2

(3 marks)

(b) The pond is a prism and the water in the pond has a depth of 20 cm.

Calculate the number of litres of water in the pond.

..... litres

(3 marks)

(c) After a rainfall, the number of litres of water in the pond is 1007.

Calculate the increase in the depth of water in the pond.
Give your answer in centimetres.

..... cm

(3 marks)

11 (a) A sphere has radius x cm. The volume of the sphere is 1000 cm^3.

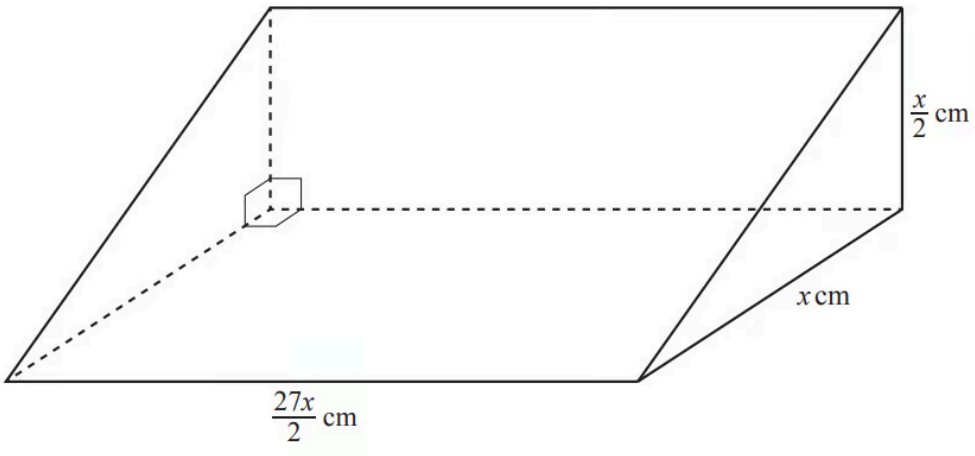
Calculate the value of x.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$x =$ .....

(3 marks)

(b)



The diagram shows a prism with a right-angled triangle as its cross-section. The volume of the prism is 1000 cm^3.

Calculate the value of x.

$x =$ .....

(4 marks)

12 A gold model is made.
This model is a prism with a cross-section of area 77.44 cm^2.

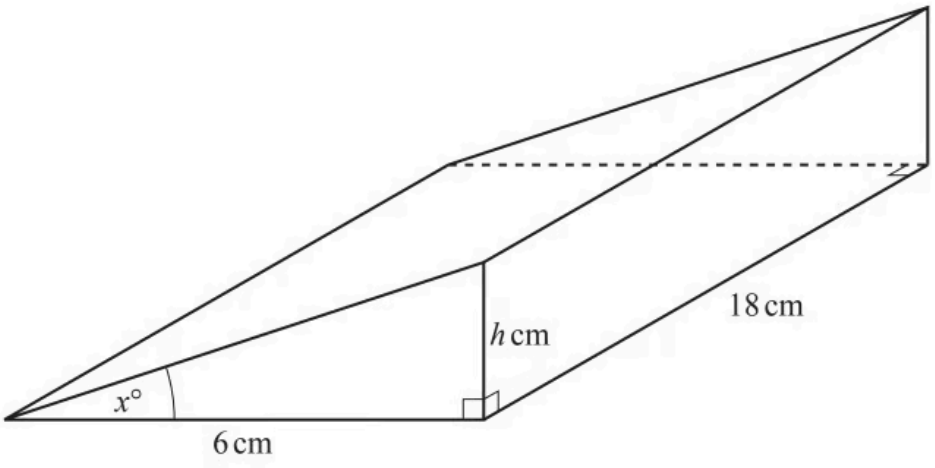
This gold model is 15 mm thick.
One cubic centimetre of gold has a mass of 19 grams.

Calculate the mass of the gold model in kilograms.

..... kg

(3 marks)

13 (a)



NOT TO SCALE

The diagram shows a prism with length 18 cm and volume 253.8 cm^3.
The cross-section of the prism is a right-angled triangle with base 6 cm and height h cm.

Show that the value of h is 4.7 .

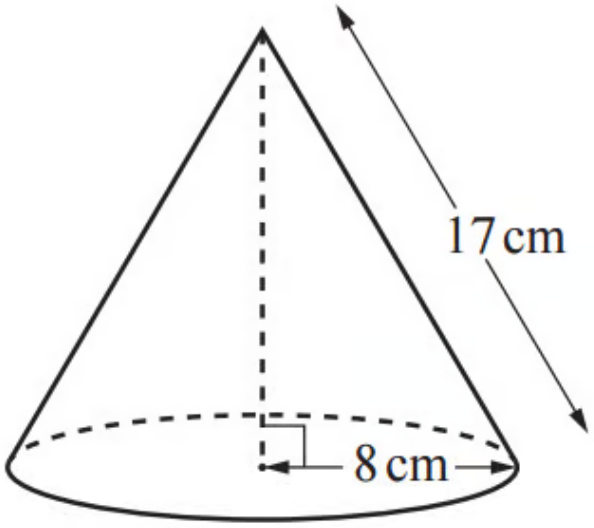
(3 marks)

(b) Calculate the total surface area of the prism.

..... cm^2

(6 marks)

14 (a)



NOT TO SCALE

The diagram shows a solid cone.
The radius is 8 cm and the slant height is 17 cm.

i) Calculate the curved surface area of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

..... cm^2 [2]

ii) Calculate the volume of the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [4]

(6 marks)

(b) i) The cone is made of wood and 1 cm^3 of the wood has a mass of 0.8 g.

Calculate the mass of the cone.

..... g [1]

ii) The cone is placed in a box.
The total mass of the cone and the box is 1.2 kg.

Calculate the mass of the box.
Give your answer in grams.

..... g [1]

(2 marks)

15 (a) A solid hemisphere has volume 230 cm^3.

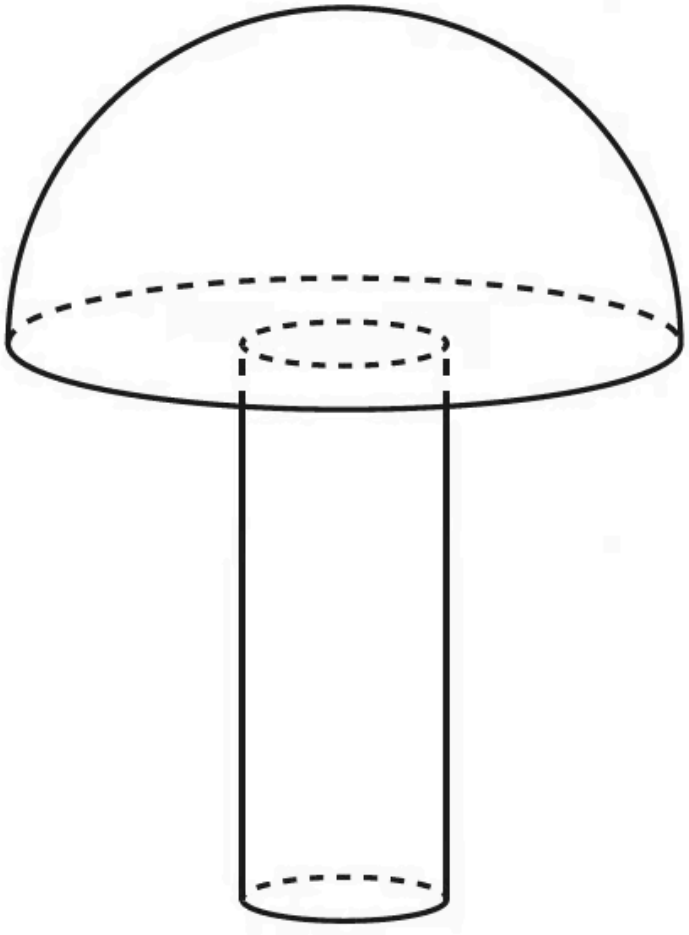
Calculate the radius of the hemisphere.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm

(3 marks)

(b) A solid cylinder with radius 1.6 cm is attached to the hemisphere to make a toy.



NOT TO SCALE

The total volume of the toy is 300 cm^3.

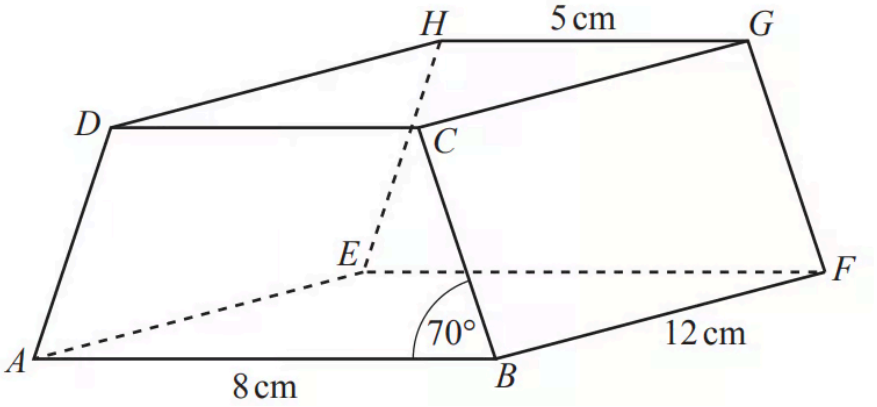
Calculate the height of the cylinder.

..... cm

(3 marks)

Very Hard Questions

1



NOT TO SCALE

The diagram shows a prism with a rectangular base, *ABFE*.
The cross-section, *ABCD*, is a trapezium with *AD* = *BC*.
AB = 8 cm, *GH* = 5 cm, *BF* = 12 cm and angle *ABC* = 70°.

Calculate the total surface area of the prism.

..... cm^2

(6 marks)

2 (a) A cylinder with radius 6 cm and height h cm has the same volume as a sphere with radius 4.5 cm.

Find the value of h.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$h =$ .....

(3 marks)

(b) A solid metal cube of side 20 cm is melted down and made into 40 solid spheres, each of radius r cm.

Find the value of r.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$r =$ .....

(3 marks)

3 (a) A solid metal cone has radius 1.65 cm and slant height 4.70 cm.

Calculate the **total** surface area of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

..... cm^2

(2 marks)

(b) Calculate the volume of the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3

(4 marks)

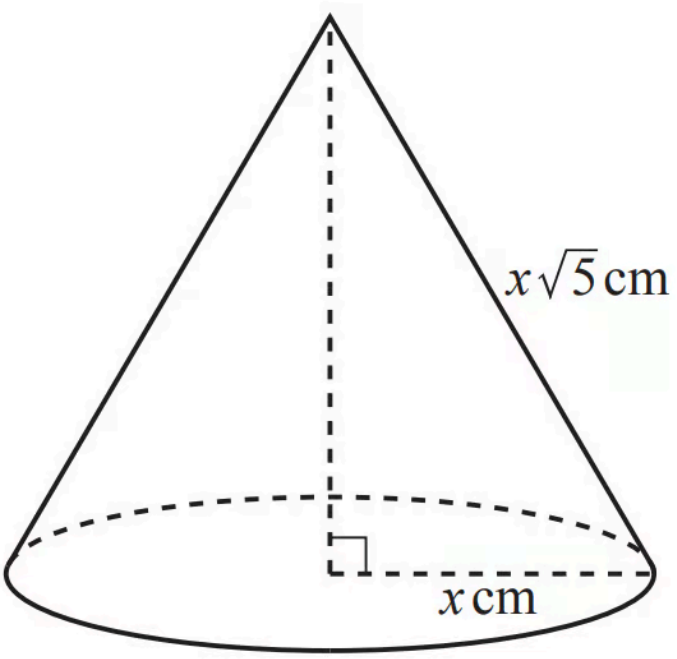
(c) A metal sphere with radius 5 cm is melted down to make cones identical to this one.

Calculate the number of complete identical cones that are made.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

(4 marks)

4



NOT TO SCALE

A cone has radius x cm and slant height $x\sqrt{5}$ cm. The volume of the cone is 1000 cm^3.

Calculate the value of x.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

$x =$ .....

(4 marks)

5 (a) The volume of a solid metal sphere is 24430 cm^3.
Calculate the radius of the sphere.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm

(3 marks)

(b) The metal sphere is placed in an empty tank.
The tank is a cylinder with radius $50\ \text{cm}$, standing on its circular base.
Water is poured into the tank to a depth of $60\ \text{cm}$.

Calculate the number of litres of water needed.

..... litres

(3 marks)

6 (a)

The diagram shows a hemispherical bowl of radius 5.6 cm and a cylindrical tin of height 10 cm.

Show that the volume of the bowl is 368 cm^3, correct to the nearest cm^3.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

(2 marks)

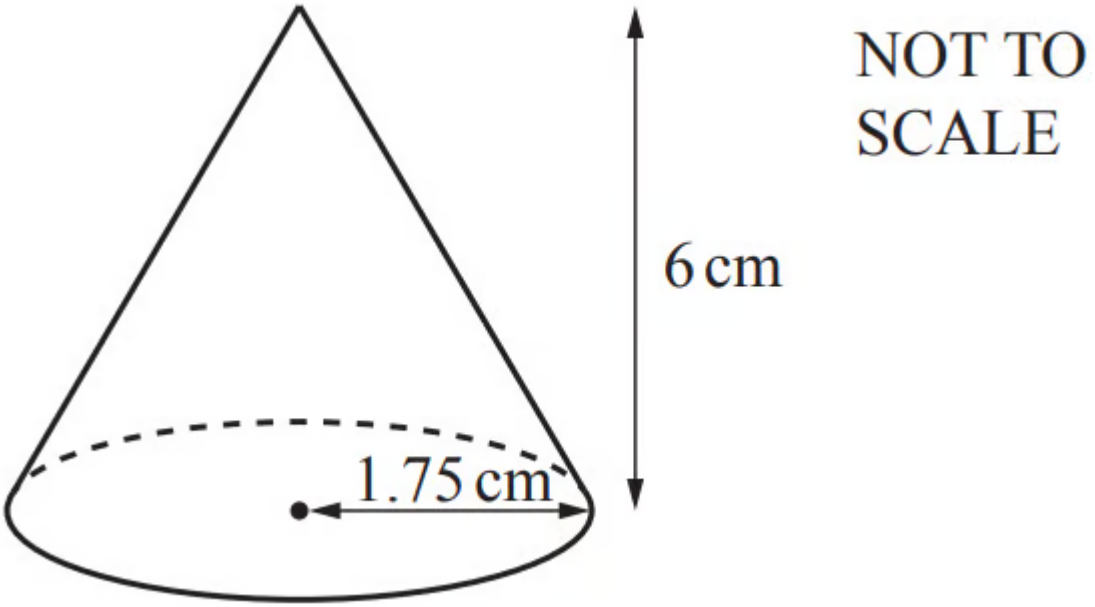
(b) The tin is completely full of soup.
When all the soup is poured into the empty bowl, 80% of the volume of the bowl is filled.

Calculate the radius of the tin.

..... cm

(4 marks)

7 (a)



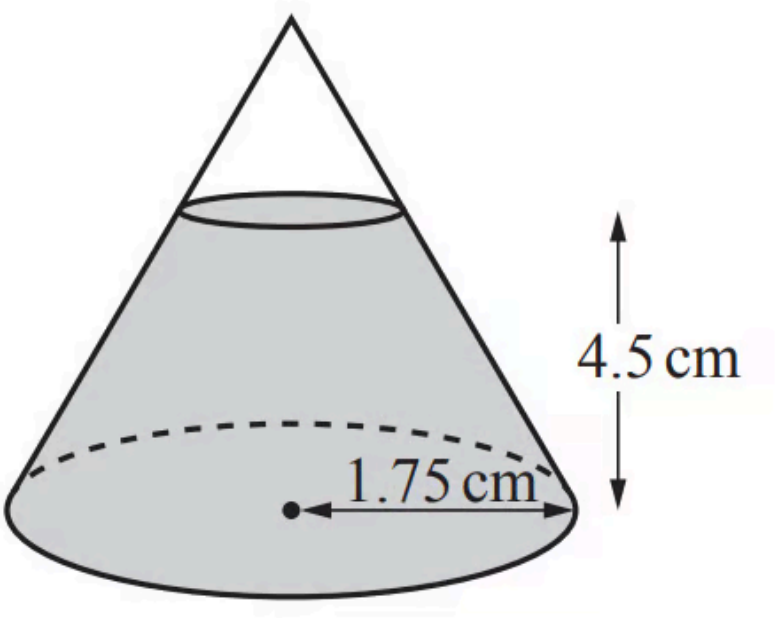
The diagram shows a cone with radius 1.75 cm and height 6 cm.

Calculate the total surface area of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

..... cm^2

(5 marks)

(b)



The cone contains salt to a depth of 4.5 cm.
The top layer of the salt forms a circle that is parallel to the base of the cone.

Show that the volume of the salt inside the cone is 18.9 cm^3, correct to 1 decimal place.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

(4 marks)

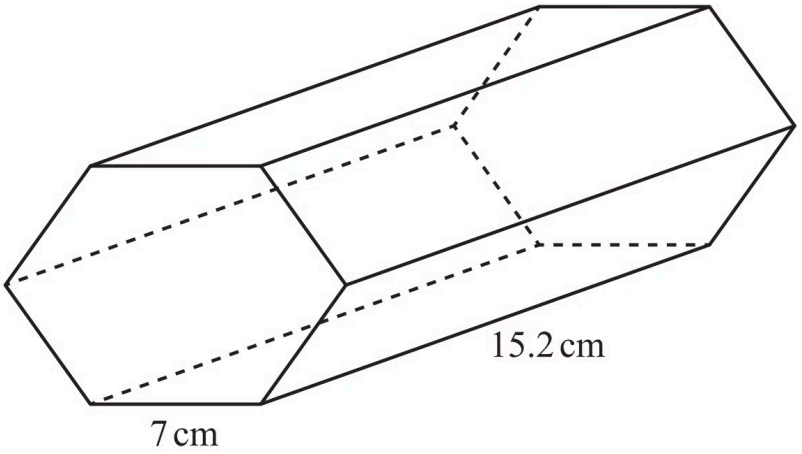
(c) The salt is removed from the cone at a constant rate of 200 mm^3 per second.

Calculate the time taken for the cone to be completely emptied.
Give your answer in seconds, correct to the nearest second.

..... s

(3 marks)

8 (a)



NOT TO SCALE

The diagram shows a solid prism with length 15.2 cm. The cross-section of this prism is a **regular** hexagon with side 7 cm.

Calculate the volume of the prism.

..... cm^3

(5 marks)

(b) Calculate the total surface area of the prism.

..... cm^2

(3 marks)

9 A solid metal prism with volume 500 cm^3 is melted and made into 6 identical spheres.

Calculate the radius of each sphere.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm

(3 marks)