Mensuration P4

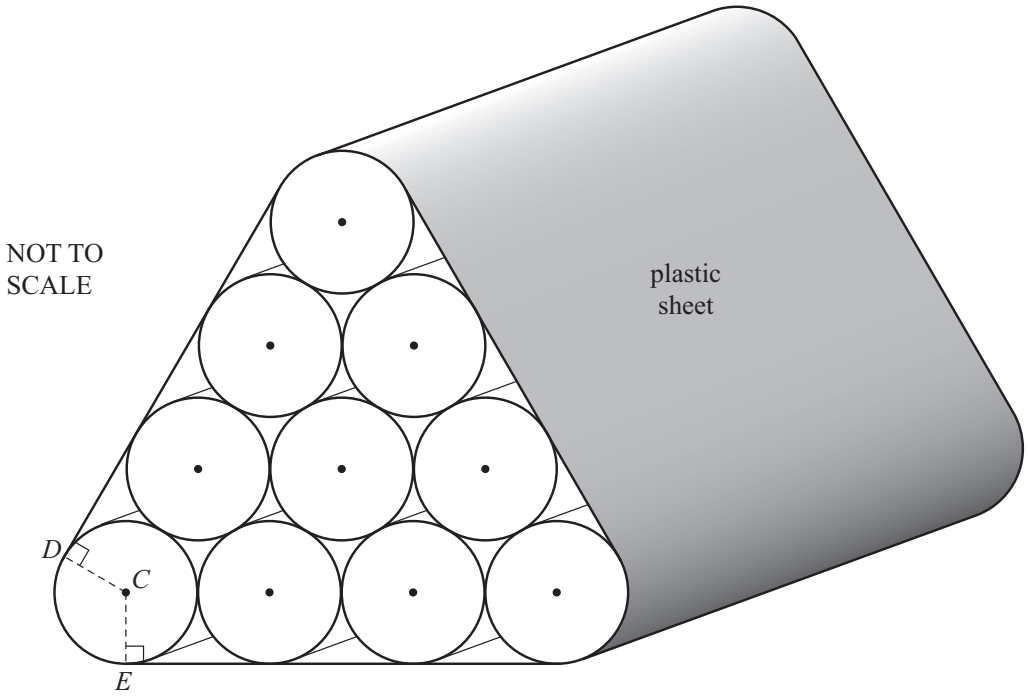
1) **(a)** Calculate the volume of a cylinder of radius 31 **centimetres** and length 15 **metres**.
Give your answer in cubic metres.

Answer(a) m^3 [3]

(b) A tree trunk has a circular cross-section of radius 31 cm and length 15 m.
One cubic metre of the wood has a mass of 800 kg.
Calculate the mass of the tree trunk, giving your answer in tonnes.

Answer(b) tonnes [2]

(c)



The diagram shows a pile of 10 tree trunks.
Each tree trunk has a circular cross-section of radius 31 cm and length 15 m.
A plastic sheet is wrapped around the pile.

C is the centre of one of the circles.
CE and *CD* are perpendicular to the straight edges, as shown.

(i) Show that angle $ECD = 120°$.

Answer(c)(i)

[2]

(ii) Calculate the length of the arc DE, giving your answer in metres.

Answer(c)(ii) m [2]

(iii) The edge of the plastic sheet forms the perimeter of the cross-section of the pile.
The perimeter consists of three straight lines and three arcs.
Calculate this perimeter, giving your answer in metres.

Answer(c)(iii) m [3]

(iv) The plastic sheet does not cover the two ends of the pile.
Calculate the area of the plastic sheet.

Answer(c)(iv) m^2 [1]

2) A spherical ball has a radius of 2.4 cm.

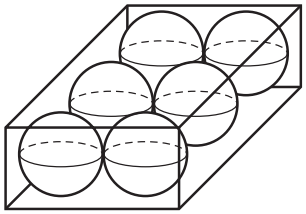
(a) Show that the volume of the ball is 57.9 cm^3, correct to 3 significant figures.

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

Answer(a)

[2]

(b)



NOT TO SCALE

Six spherical balls of radius 2.4 cm fit exactly into a **closed** box.
The box is a cuboid.

Find

(i) the length, width and height of the box,

Answer(b)(i) ..... cm, ... cm, ... cm [3]

(ii) the volume of the box,

Answer(b)(ii) ..... cm^3 [1]

(iii) the volume of the box **not** occupied by the balls,

Answer(b)(iii) ..... cm^3 [1]

(iv) the surface area of the box.

Answer(b)(iv) ..... cm^2 [2]

(c)

NOT TO SCALE

The six balls can also fit exactly into a **closed** cylindrical container, as shown in the diagram.

Find

(i) the volume of the cylindrical container,

Answer(c)(i) cm^3 [3]

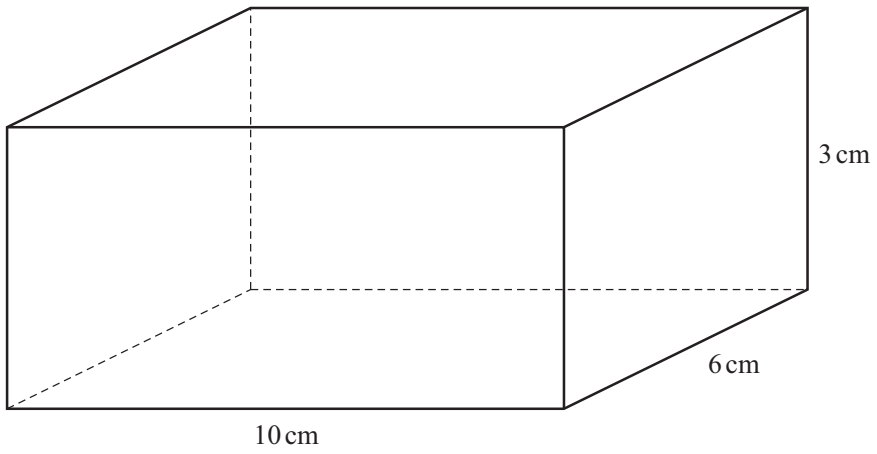
(ii) the volume of the cylindrical container **not** occupied by the balls,

Answer(c)(ii) cm^3 [1]

(iii) the surface area of the cylindrical container.

Answer(c)(iii) cm^2 [3]

3)



A solid metal cuboid measures 10 cm by 6 cm by 3 cm.

(a) Show that 16 of these solid metal cuboids will fit exactly into a box which has internal measurements 40 cm by 12 cm by 6 cm.

Answer(a)

[2]

(b) Calculate the volume of **one** metal cuboid.

Answer(b) cm^3 [1]

(c) One cubic centimetre of the metal has a mass of 8 grams.
The box has a mass of 600 grams.

Calculate the **total** mass of the 16 cuboids **and** the box in

(i) grams,

Answer(c)(i) g [2]

(ii) kilograms.

Answer(c)(ii) kg [1]

(d) **(i)** Calculate the surface area of **one** of the solid metal cuboids.

Answer(d)(i) cm^2 [2]

(ii) The surface of each cuboid is painted. The cost of the paint is \$25 per **square metre**.

Calculate the cost of painting all **16** cuboids.

Answer(d)(ii) \$ [3]

(e) **One** of the solid metal cuboids is melted down.
Some of the metal is used to make 200 identical solid spheres of radius 0.5 cm.

Calculate the volume of metal from this cuboid which is **not** used.

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

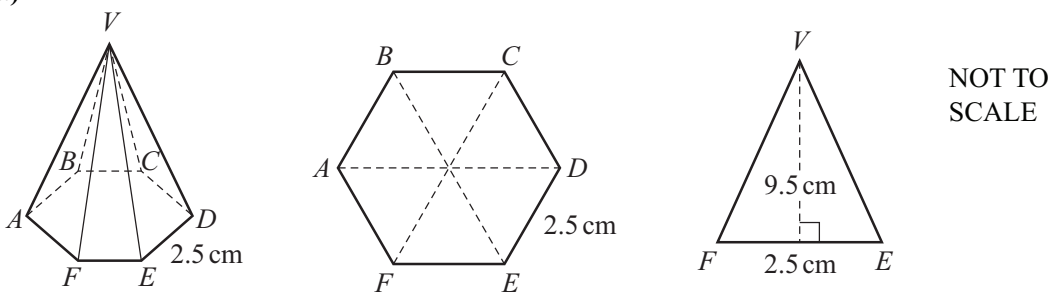
Answer(e) cm^3 [3]

(f) 50 cm^3 of metal is used to make 20 identical solid spheres of radius r.

Calculate the radius r.

Answer(f) $r =$ cm [3]

4) **(a)**



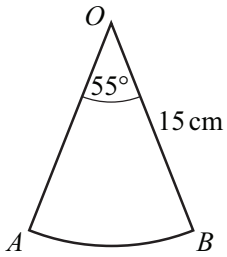
NOT TO SCALE

A solid pyramid has a **regular hexagon** of side 2.5 cm as its base.
Each sloping face is an isosceles triangle with base 2.5 cm and height 9.5 cm.

Calculate the **total** surface area of the pyramid.

Answer(a) cm^2 [4]

(b)



NOT TO SCALE

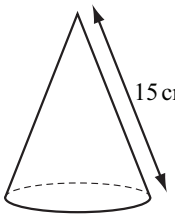
A sector *OAB* has an angle of 55° and a radius of 15 cm.

Calculate the area of the sector and show that it rounds to 108 cm^2, correct to 3 significant figures.

Answer (b)

[3]

(c)



NOT TO SCALE

The sector radii *OA* and *OB* in **part (b)** are joined to form a cone.

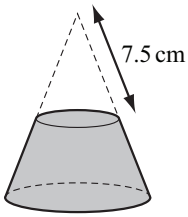
(i) Calculate the base radius of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Answer(c)(i) ..... cm [2]

(ii) Calculate the perpendicular height of the cone.

Answer(c)(ii) ..... cm [3]

(d)



NOT TO SCALE

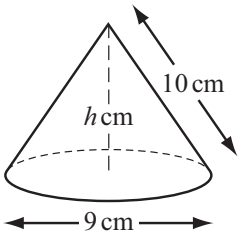
A solid cone has the same dimensions as the cone in **part (c)**.
A small cone with slant height 7.5 cm is removed by cutting parallel to the base.

Calculate the volume of the remaining solid.

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

Answer(d) ..... cm^3 [3]

5)



NOT TO SCALE

A solid cone has diameter 9 cm, slant height 10 cm and vertical height h cm.

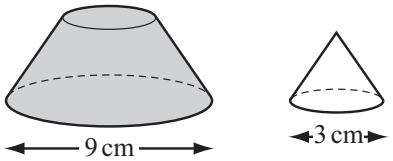
(a) **(i)** Calculate the curved surface area of the cone.
[The curved surface area, A, of a cone, radius r and slant height l is $A = \pi rl$.]

Answer(a)(i) cm^2 [2]

(ii) Calculate the value of h, the vertical height of the cone.

Answer(a)(ii) $h =$ [3]

(b)



NOT TO SCALE

Sasha cuts off the top of the cone, making a smaller cone with diameter 3 cm.
This cone is **similar** to the original cone.

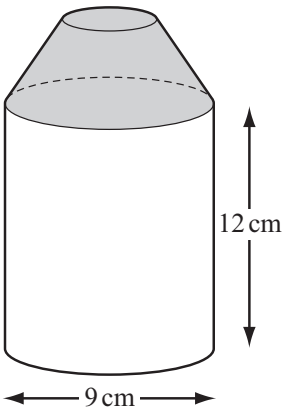
(i) Calculate the **vertical** height of this small cone.

Answer(b)(i) cm [2]

(ii) Calculate the curved surface area of this small cone.

Answer(b)(ii) cm^2 [2]

(c)

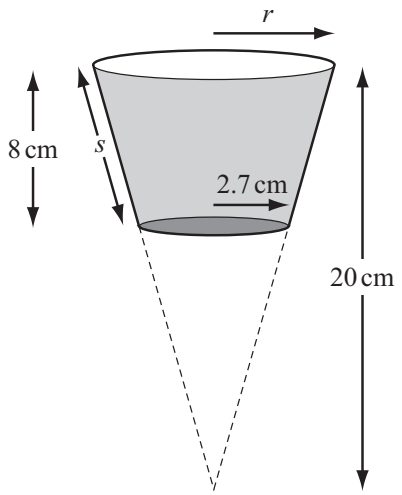


NOT TO SCALE

The shaded solid from **part (b)** is joined to a solid cylinder with diameter 9 cm and height 12 cm.
Calculate the **total** surface area of the whole solid.

Answer(c) cm^2 [5]

6)



NOT TO SCALE

The diagram shows a plastic cup in the shape of a cone with the end removed.
The vertical height of the cone in the diagram is 20 cm.
The height of the cup is 8 cm.
The base of the cup has radius 2.7 cm.

(a) **(i)** Show that the radius, r, of the circular top of the cup is 4.5 cm.

Answer(a)(i)

[2]

(ii) Calculate the volume of water in the cup when it is full.

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

Answer(a)(ii) cm^3 [4]

(b) **(i)** Show that the slant height, s, of the cup is 8.2 cm.

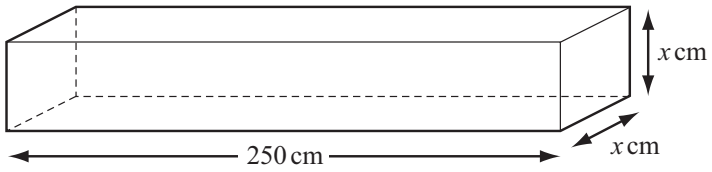
Answer(b)(i)

[3]

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

Answer(b)(ii) cm^2 [5]

7)



NOT TO SCALE

A solid metal bar is in the shape of a cuboid of length of 250 cm.
The cross-section is a square of side x cm.
The volume of the cuboid is 4840 cm^3.

(a) Show that $x = 4.4$.

Answer (a)

[2]

(b) The mass of 1 cm^3 of the metal is 8.8 grams.
Calculate the mass of the whole metal bar in kilograms.

Answer(b) kg [2]

(c) A box, in the shape of a cuboid measures 250 cm by 88 cm by h cm.
120 of the metal bars fit exactly in the box.
Calculate the value of h.

Answer(c) $h =$ [2]

(d) One metal bar, of volume 4840 cm^3, is melted down to make 4200 identical small spheres.

All the metal is used.

(i) Calculate the radius of each sphere. Show that your answer rounds to 0.65 cm, correct to 2 decimal places.

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

Answer(d)(i)

[4]

(ii) Calculate the surface area of each sphere, using 0.65 cm for the radius.

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

Answer(d)(ii) . cm^2 [1]

(iii) Calculate the total surface area of all 4200 spheres as a percentage of the surface area of the metal bar.

Answer(d)(iii) % [4]