

1MA1 Higher themed papers: Spheres and Cones

Write your name here			
Surname	Other names		
Centre Number		Candidate Number	
Pearson Edexcel Level 1/Level 2 GCSE (9–1)			
Mathematics Spheres and Cones			
		Paper Reference 1MA1	
You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.			Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

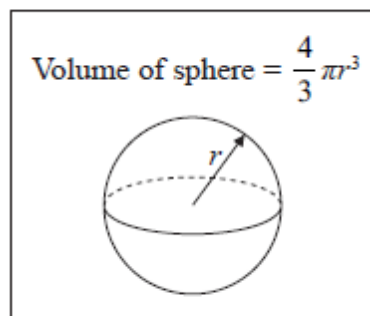
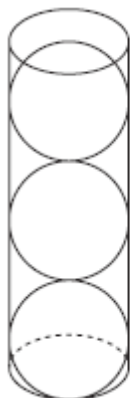
- The total mark for this paper is **47**. There are **12** questions.
- Questions have been arranged in an ascending order of mean difficulty, as found by all students in the June 2017–November 2019 examinations.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

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- 1 A hollow cylinder has radius r cm and height $6r$ cm.
3 spheres, also of radius r cm, are put into the cylinder.



- (a) Work out the proportion of the cylinder that is **not** filled by the spheres.

.....
(3)

The height of the cylinder is increased by $2r$ cm.
Another sphere of radius r cm is put into the cylinder.

Malcolm says,

“There is no change in the proportion of the cylinder **not** filled by the spheres.”

- (b) Is Malcolm correct?
Justify your answer.

.....
.....
(1)

(Total for Question 1 is 4 marks)

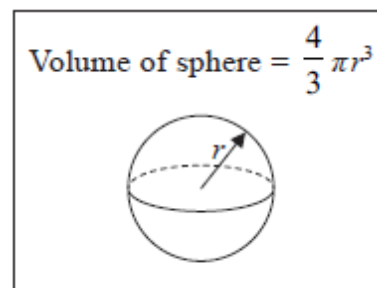
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- 2 Jan has some metal that she is going to make into solid metal spheres.

Each sphere will have a radius of 2.15 cm.

Jan has 1490 cm^3 of metal.



- (a) Work out an estimate for the number of spheres that Jan can make.

.....
(3)

- (b) If you calculate the number of spheres accurately, how do you think your answer to part (a) will change?
Give a reason for your answer.

.....
.....
.....
(1)

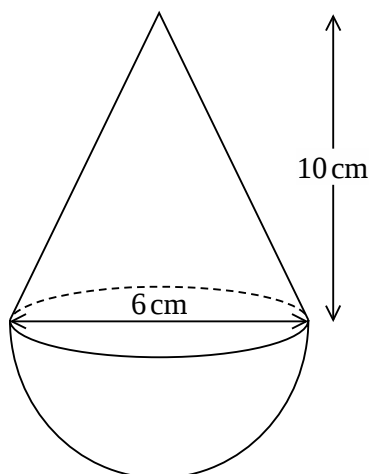
(Total for Question 2 is 4 marks)

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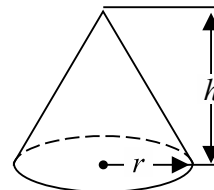


3

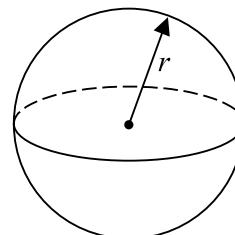
The diagram shows a solid shape.
The shape is a cone on top of a hemisphere.



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



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



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 .

$k = \dots\dots\dots$

(Total for Question 3 is 4 marks)

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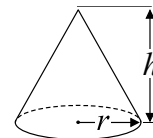


4

A cone has a volume of 98 cm^3 .
The radius of the cone is 5.13 cm .

(a) Work out an estimate for the height of the cone.

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



.....cm
(3)

John uses a calculator to work out the height of the cone to 2 decimal places.

(b) Will your estimate be more than John's answer or less than John's answer?
Give reasons for your answer.

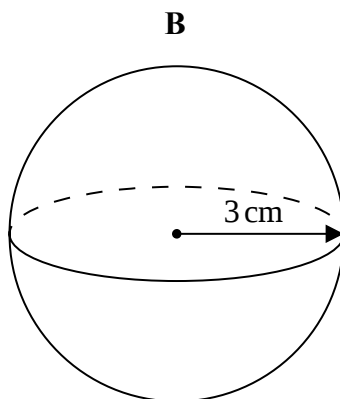
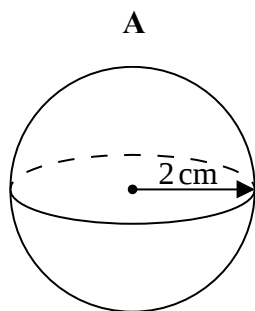
.....
.....
.....
(1)

(Total for Question 4 is 4 marks)

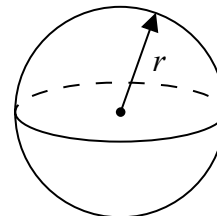
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- 5 Here are two solid spheres, **A** and **B**.



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



Sphere **A** is made of gold.
Sphere **B** is made of silver.

Sphere **A** has radius 2 cm.
Sphere **B** has radius 3 cm.

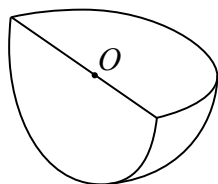
Gold has a density of 19 000 kg/m³
Silver has a density of 10 000 kg/m³

Which sphere has the greater mass?
You must show how you get your answer.

(Total for Question 5 is 4 marks)

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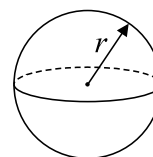
- 6** Shape **S** is one quarter of a solid sphere, centre **O**.



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.

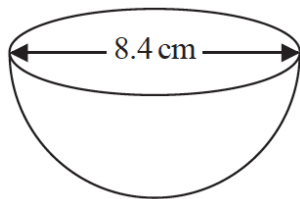
You must show your working.

..... cm^2

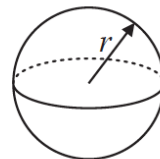
(Total for Question 6 is 5 marks)

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- 7 The diagram shows a hemisphere with diameter 8.4 cm.



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



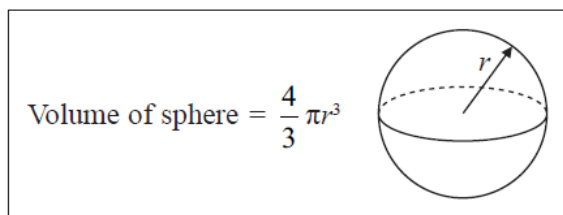
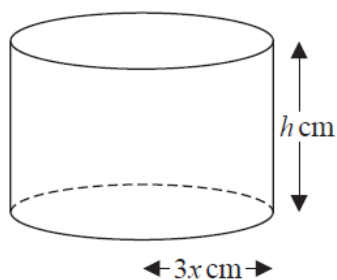
Work out the volume of the hemisphere.
Give your answer correct to 3 significant figures.

..... cm³

(Total for Question 7 is 2 marks)

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- 8 The diagram shows a solid metal cylinder.



The cylinder has base radius $3x \text{ cm}$ and height $h \text{ cm}$.

The metal cylinder is melted.

All the metal is then used to make 270 spheres.

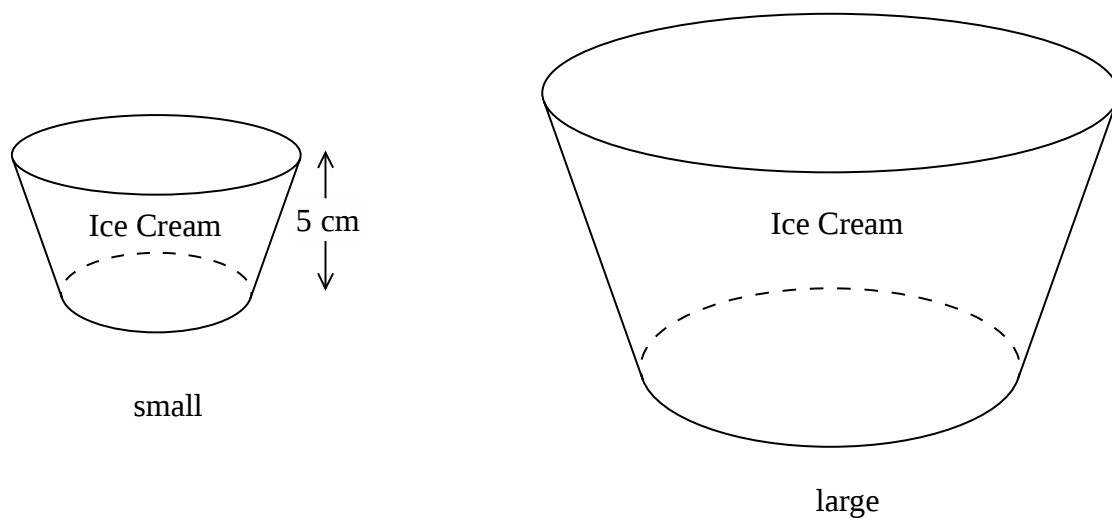
Each sphere has a radius of $\frac{1}{2}x \text{ cm}$.

Find an expression, in its simplest form, for h in terms of x .

.....
(Total for Question 8 is 3 marks)

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- 9** A factory makes ice cream tubs in two sizes, small and large.



The tubs are similar in shape.

The height of the small tub is 5 cm.

The volume of the small tub is 150 cm^3 .

The volume of the large tub is 500 cm^3 .

Work out the height of the large tub.

Give your answer correct to 3 significant figures.

.....cm

(Total for Question 9 is 2 marks)

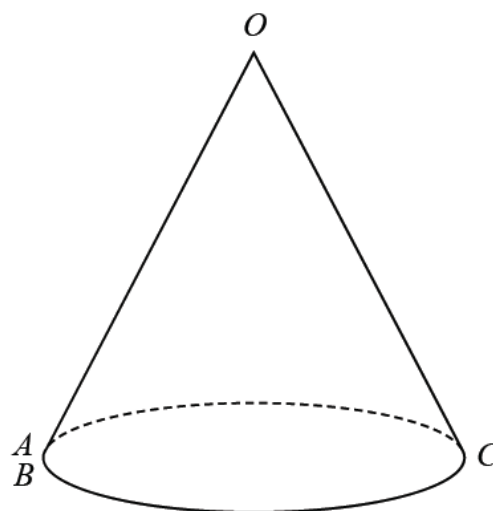
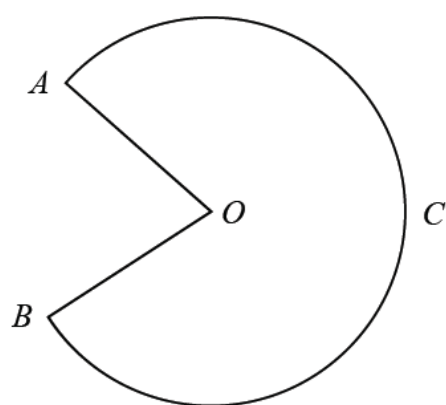
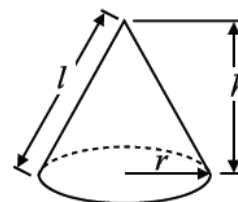
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- 10 The diagram shows a sector $OACB$ of a circle with centre O .
The point C is the midpoint of the arc AB .

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

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

$$\text{Curved surface area of cone} = \pi r l$$



The cone has volume 56.8 cm^3 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.

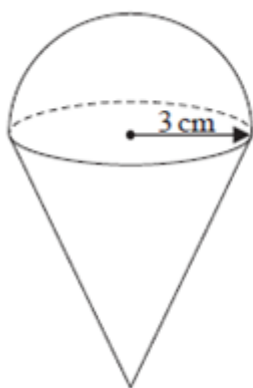
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.....^o
(Total for Question 10 is 5 marks)

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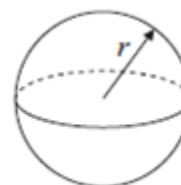
- 11 The diagram shows a solid made by joining a solid hemisphere to a solid circular cone.

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



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

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



$$\text{Curved surface area of cone} = \pi r l$$

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



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.

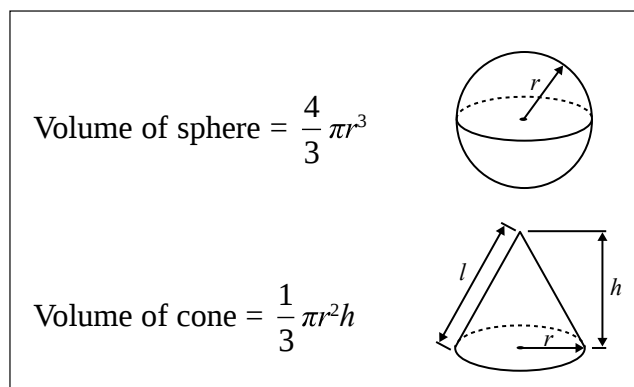
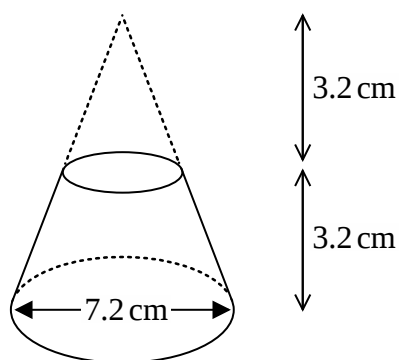
Give your answer as a multiple of π .

..... cm^2

(Total for Question 11 is 5 marks)

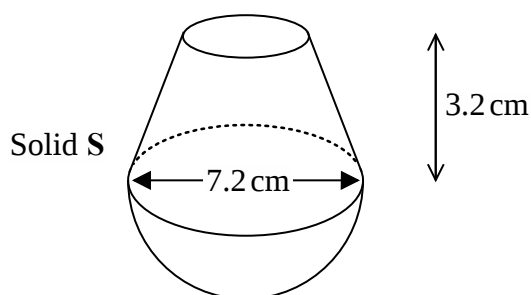
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12 Here is a frustum of a cone.



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/cm^3

The density of the hemisphere is 4.8 g/cm^3

Calculate the average density of solid S.

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.....g/cm³

(Total for Question 12 is 5 marks)

TOTAL MARKS FOR PAPER: 47