Name: _____

GCSE (1 – 9)

Spheres and Cones

Instructions

- Use **black** ink or ball-point pen.
- Answer all Questions.
- Answer the Questions in the spaces provided
  – *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
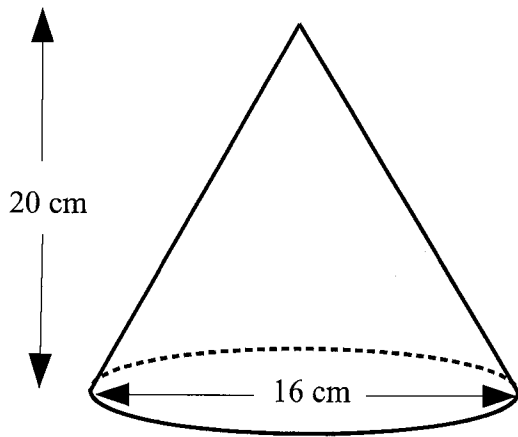- You must **show all your working out.**

Information

- The marks for each Question are shown in brackets
  – *use this as a guide as to how much time to spend on each Question.*
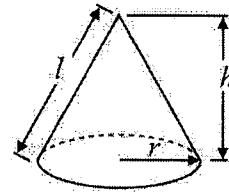
Advice

- 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

1 The diagram shows a cone.

20 cm

16 cm

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

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

The height of the cone is 20 cm.
The base of the cone has a diameter of 16 cm. $r = 8\ cm$
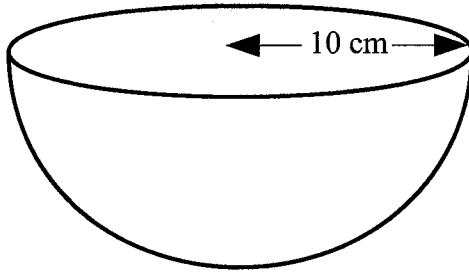
Work out the volume of the cone.
Give your answer correct to 3 significant figures.

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

$$= \frac{1}{3}\pi (8)^2 (20)$$
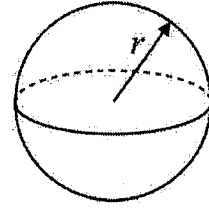
$$= 1340\ cm^3$$

1340 .... cm³

(Total for Question 1 is 2 marks)

2   The diagram shows a solid hemisphere with a radius of 10 cm.

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

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

Work out the total surface area of the hemisphere.
Give your answer in terms of π.

$$Area \ of \ circle = \pi (10)^2$$
$$= 100\pi$$

$$Curved \ area = \dfrac{4\pi(10)^2}{2}$$
$$= 200\pi$$

$$100\pi + 200\pi = \underline{300\pi}$$

..............300π.............. cm^2

(Total for Question 2 is 3 marks)

3 The diagram shows a ~~Solid~~ cone.
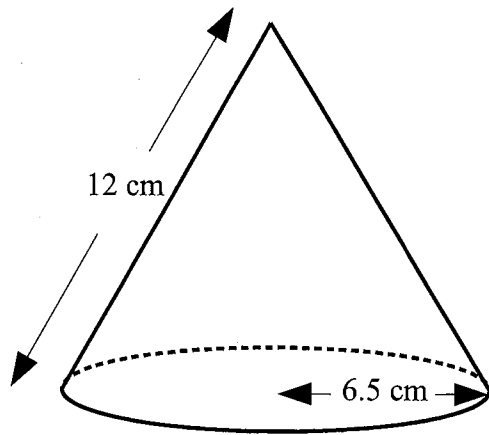
12 cm

6.5 cm

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

Curved surface area of cone $= \pi r l$
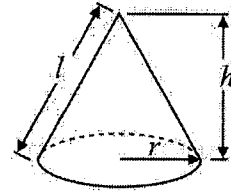
The slanted height of the cone is 12 cm.
The base of the cone has a radius of 6.5 cm.

Work out the total surface area of the cone.
Give your correct to 3 significant figures.

Curved surface area $= \pi (6.5)(12)$

$= 78\pi$

area of circle $= \pi (6.5)^2$

$= \frac{169}{4}\pi$

$78\pi + \frac{169}{4}\pi = 378 \text{ cm}^2$

_____378_____ cm²

(Total for Question 3 is 3 marks)

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

12 cm

10 cm

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

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$
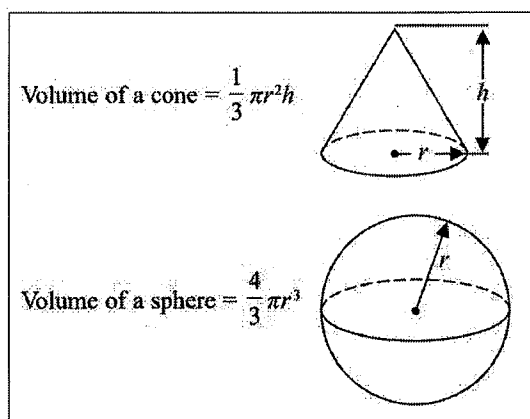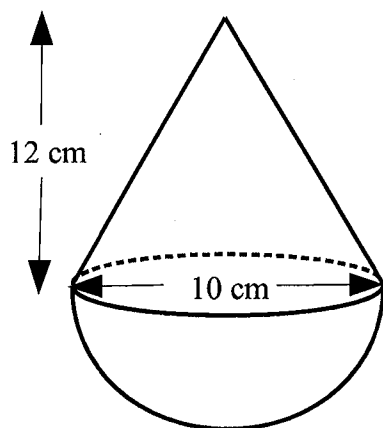
The height of the cone is 12 cm.
The base of the cone has a diameter of 10 cm. $r = 5$
The diameter of the hemisphere is 10 cm.

Work out the total volume of the solid shape.
Give your answer in terms of π.
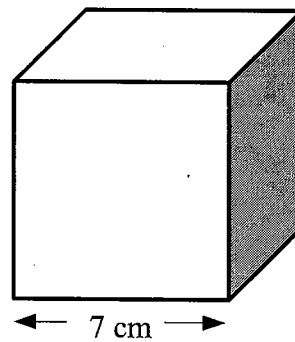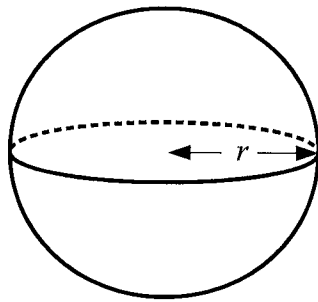
$$\text{volume of cone} = \frac{1}{3}\pi(5)^2(12)$$

$$= 100\pi$$

$$\text{volume of hemisphere} = \frac{2}{3}\pi(5)^3$$

$$= \frac{250}{3}\pi$$

$$\text{total volume} = 100\pi + \frac{250}{3}\pi$$

$$= \frac{550}{3}\pi$$

$\dfrac{550}{3}\pi$ .... cm³
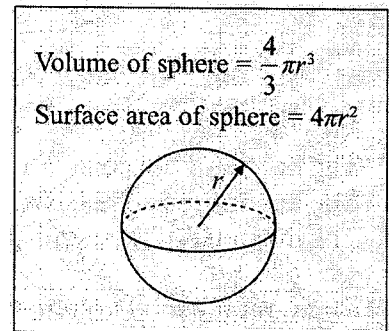
(Total for Question 4 is 4 marks)

5   The diagram shows a sphere and a cube.

The cube has length 7 cm.

The sphere and the cube have the same volume.
Work out the radius of the sphere.

Give your answer correct to 3 significant figures.

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

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

volume of cube $= 7 \times 7 \times 7$
$= 343$ cm^3

$\frac{4}{3}\pi r^3 = 343$

$4\pi r^3 = 1029$
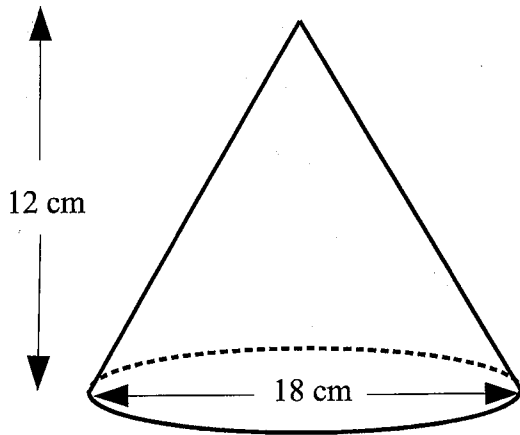
$r^3 = \frac{1029}{4\pi}$

$r^3 = 81.885\ldots$

$r = \sqrt[3]{81.885}$

$= 4.34$ cm

4.34 .... cm
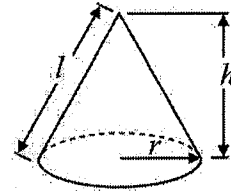
(Total for Question 5 is 3 marks)

6 The diagram shows a cone. solid

12 cm

18 cm

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

Curved surface area of cone $= \pi r l$
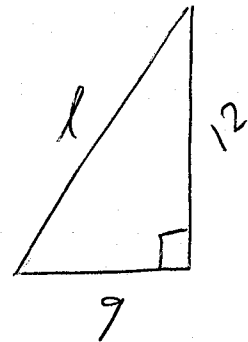
The height of the cone is 12 cm.
The base of the cone has a diameter of 18 cm. $r = 9 cm$

Work out the total surface area of the cone.
Give your answer in terms of π.

l 12

9

$l^2 = 9^2 + 12^2$

$l^2 = 225$

$l = \sqrt{225}$

$= 15 cm$

Area of circle $= \pi(9)^2$

$= 81\pi$

Curved area $= \pi(9)(15)$

$= 135\pi$

Total surface area $= 81\pi + 135\pi$

$= 216\pi$

216π cm^2

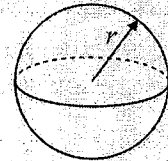**(Total for Question 6 is 4 marks)**
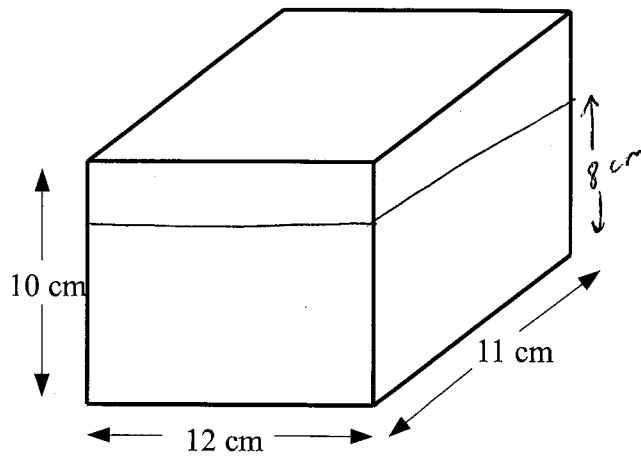
A rectangular container is 12 cm long, 11 cm wide and 10 cm high.
The container is filled with water to a depth of 8 cm.

A metal sphere of radius 3.5 cm is placed in the water.
It sinks to the bottom.

Calculate the rise in the water level.
Give your answer correct to 3 significant figures

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

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

volume of sphere $= \dfrac{4}{3}\pi(3.5)^3$

$= \dfrac{343}{6}\pi$ cm^3

volume of water $= 12 \times 11 \times 8$

$= 1056$ cm^3

Total volume $= 1235.59$ cm^3

$12 \times 11 \times h = 1235.59$

$h = \dfrac{1235.59}{12 \times 11}$

$= 9.36$ cm

$9.36 - 8$
$= 1.36$ cm

............1.36............ cm

(Total for Question 7 is 4 marks)