Name:

Exam Style Questions

Volume of a Sphere

Corbettmaths

Equipment needed: Calculator, pen

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

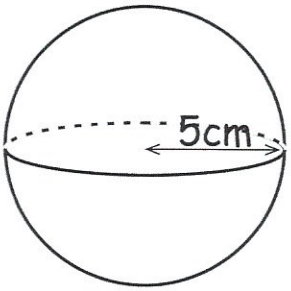
Video Tutorial

www.corbettmaths.com/contents

Video 361

Answers and Video Solutions

1. The diagram shows a sphere with radius 5cm.



Work out the volume of the sphere.
Give your answer to 1 decimal place.

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

$= \frac{4}{3} \times \pi \times 5^3$

$= 523.59877...$

523.6 .....cm³

(3)

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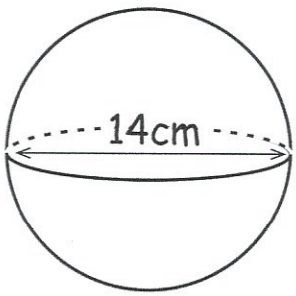
2. The diagram shows a sphere with diameter 14cm.



Work out the volume of the sphere.
Give your answer to 1 decimal place.

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

$= \frac{4}{3} \times \pi \times 7^3$

$= 1436.755...$

1436.8 .....cm³

(3)

3. A sphere has radius 2cm.
Calculate the volume of the sphere.
Give your answer to 1 decimal place.

$V = \frac{4}{3} \times \pi \times 2^3$

$= 33.5103... \text{ cm}^3$

33.5 .....cm³

(3)

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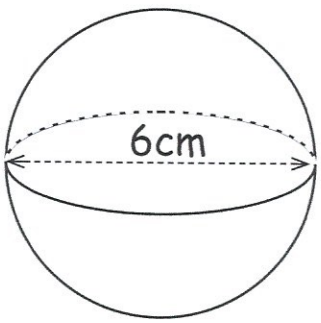
4. Shown is a sphere with diameter 6cm.



$\frac{4}{3}$ of 27 = 36

Calculate the volume of the sphere.
Give your answer in terms of π

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

$= \frac{4}{3} \times \pi \times 3^3$

$= \frac{4}{3} \times \pi \times 27$

$= 36\pi$

36π .....cm³

(3)

5. A solid wooden sphere has a radius of 5.98cm

Work out an estimate for the volume of the sphere.
Give your answer in terms of π

let $r = 6$

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

$= \frac{4}{3} \times \pi \times 6^3$

$= \frac{4}{3} \times \pi \times 216$

$= 288\pi$

$6^3 = 6 \times 6 \times 6$

$= 36 \times 6$

$= 216$

$\frac{4}{3}$ of $216 = 288$

$3\overline{)216} = 72$

$72 \times 4 = 288$

288π .....cm³

(3)

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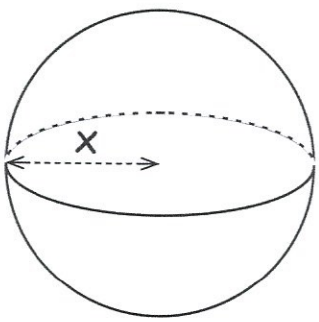
6. A sphere has volume 500cm³.



Calculate the radius of the sphere, x.
Give your answer to 2 decimal places.

$500 = \frac{4}{3}\pi x^3$

$1500 = 4\pi x^3$

$375 = \pi x^3$

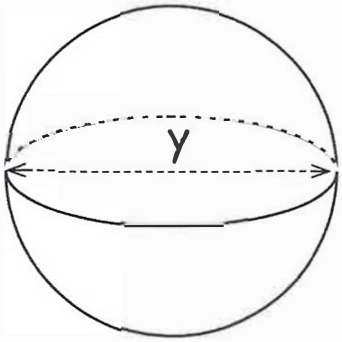
$119.366... = x^3$

$\sqrt[3]{119.366..} = 4.9237..$

4.92 .....cm

(3)

7. The volume of a sphere is 61600mm³



Work out the diameter, y, of the sphere.

$\frac{4}{3} \times \pi \times r^3 = 61600$

$4 \times \pi \times r^3 = 184800$

$\pi \times r^3 = 46200$

$r^3 = 14705.91674$

$\sqrt[3]{14705.91674} = 24.49988...$

$y = 2 \times 24.49988... = 48.9997...$

49mm

(3)

8. The volume of a sphere is 4500π cm³

Calculate the radius of the sphere.

$\frac{4}{3} \pi r^3 = 4500\pi$

$\frac{4}{3} r^3 = 4500$

$4r^3 = 13500$

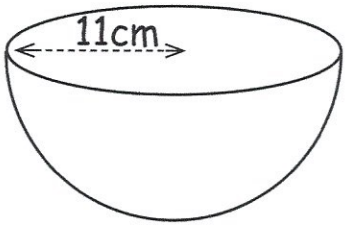
$r^3 = 3375$

$r = 15$

15 cm

(3)

9. Shown below is a hemisphere.



Calculate the volume of the hemisphere.

Sphere : $V = \frac{4}{3} \times \pi \times 11^3$

$= 5575.279763..$

Hemisphere $V = \frac{1}{2}(5575.279763..)$

$= 2787.639881..$

2787.6 ..... cm^3

(3)

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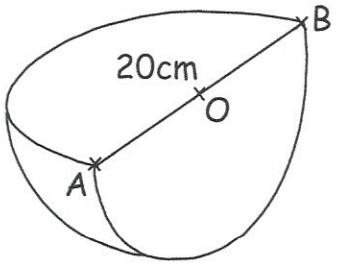
10. Shown below is a quarter of a sphere.
O is the centre of the sphere.



AB = 20cm

Work out the volume of the sphere.
Give your answer to 2 significant figures.

Sphere : $\frac{4}{3} \times \pi \times 10^3$

$= 4188.790205..$

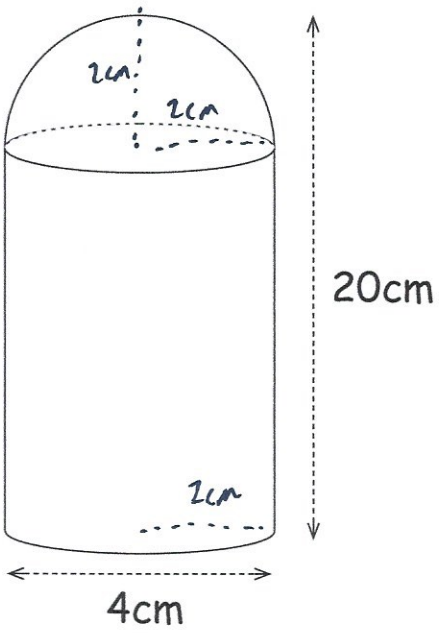
Quarter sphere : $\frac{1}{4}(4188.790205)$

$= 1047.197551$

1000 ..... cm^3

(3)

11. A container is created from a cylinder and a hemisphere.



The height of the container is 20cm.
The diameter of the cylinder is 4cm.

Calculate the volume of the container.

Cylinder : $V = \pi \times 2^2 \times 18$

$= 72\pi$ (226.1946711...)

Hemisphere : $V = \frac{1}{2}\left(\frac{4}{3} \times \pi \times 2^3\right)$

$= \frac{1}{2}(33.5103...)$

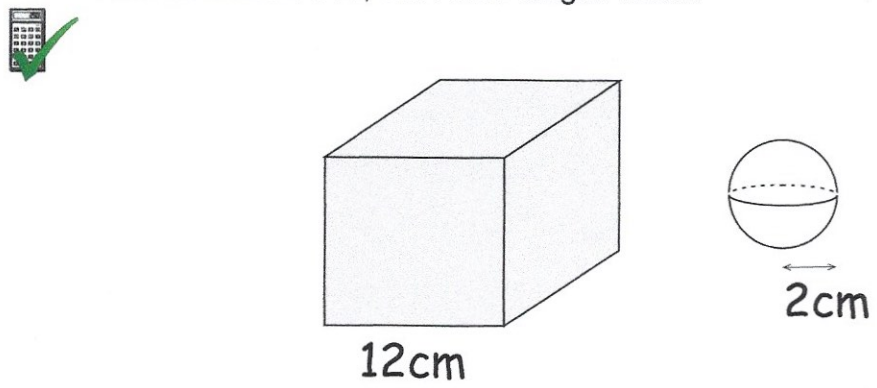
$= \frac{16}{3}\pi$ (16.755...)

$72\pi + \frac{16}{3}\pi = 242.949...$

242.95 cm³

(4)

12. A solid metal cube, with side length 12cm.



Kieran melts the metal cube and uses it to make as solid metal spheres, radius 2cm.

Work out how many spheres Kieran can make.

Cube : $12^3 = 1728 cm^3$

Sphere : $\frac{4}{3} \times \pi \times 2^3 = 33.5103... cm^3$

$1728 \div 33.5103... = 51.5662...$

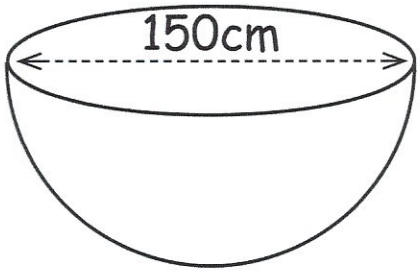
51 spheres

51

.....

(5)

13. Evelyn has built a new garden pond.
The pond is a hemisphere, diameter 150cm.



1 litre = $1000 cm^3$

0.25 litres = $250 cm^3$

She fills the pond at a rate of 0.25 litres per second.

Work out how long it takes Evelyn to fill the pond.

$V = \frac{1}{2}\left(\frac{4}{3} \times \pi \times 75^3\right)$

$= \frac{1}{2}(1767145.868)$

$= 883572.9338 cm^3$

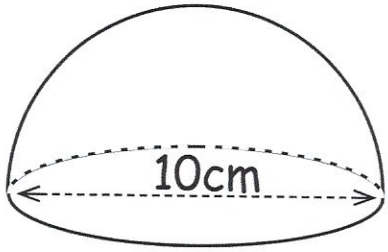
$883572.9338 \div 250 = 3534.29...$ seconds

$= 58.9$ minutes

58.9 minutes.

(4)

14. Shown below is a solid glass paperweight.



The paperweight is a hemisphere with diameter 10cm.
The density of the glass is 2.5g/cm^3

Calculate the mass of the paperweight.

$V = \frac{1}{2}\left(\frac{4}{3} \times \pi \times 5^3\right)$

$= \frac{1}{2}\left(523.5987756\right)$

$= 261.7993878 \text{ cm}^3$

$m = d \times V$

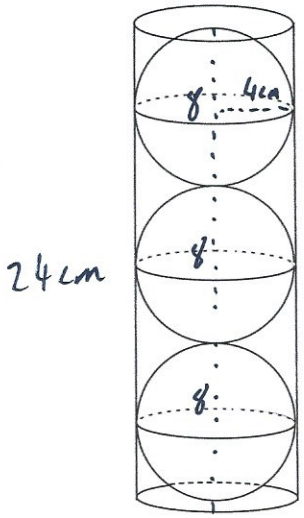
$= 2.5 \times 261.7993878$

$= 654.5\text{g}$ to 1 dp

654.5 g

(4)

15. Three spheres of radius 4cm just fit inside a tube.



Calculate the percentage of the tube that is not filled.

tube: $V = \pi \times 4^2 \times 24$

$= 1206.371579 \text{ cm}^3$ (384π)

1 sphere: $V = \frac{4}{3} \times \pi \times 4^3$

$= 268.0825... \text{ cm}^3$ $\left(\frac{256}{3}\pi\right)$

3 spheres $V = 3 \times \frac{256}{3}\pi = 256\pi$ $(804.24...)$

Not filled: $1206.371579 - 804.24... = 402.1238597$

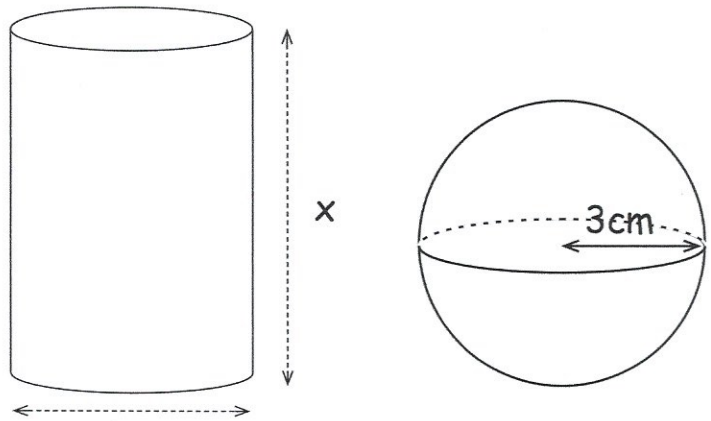
or $384\pi - 256\pi = 128\pi$

$\frac{128\pi}{384\pi} \times 100 = 33.33...$

33 1/3 ..... %

(5)

16. Shown below is a cylinder and a sphere.



$\frac{4}{3}$ of 27 = 36

Volume of the cylinder : volume of the sphere = 5 : 3

Work out the height of the cylinder, x.

Sphere: $\frac{4}{3} \times \pi \times 3^3$

$\frac{4}{3} \times \pi \times 27$

$= 36\pi \text{ cm}^3$

$36\pi \div 3 = 12\pi$

$12\pi \times 5 = 60\pi \text{ cm}^3$

Cylinder: $\pi \times 2^2 \times x = 60\pi$

$\pi \times 4 \times x = 60\pi$

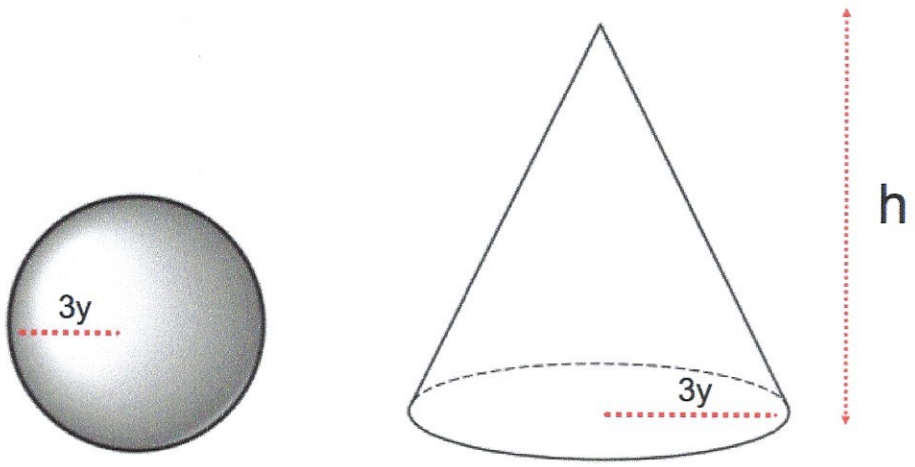
$4x = 60$

$x = 15$

15 .....cm

(4)

17. This sphere and cone have the same volume.



Find an expression for h in terms of y.

Sphere: $\frac{4}{3} \times \pi \times (3y)^3$

$= \frac{4}{3} \times \pi \times 27y^3$

$= \frac{4}{3} \pi \times 27y^3$

$= 36\pi y^3$

Cone: $\frac{1}{3} \times \pi \times (3y)^2 \times h$

$= \frac{1}{3} \times \pi \times 9y^2 \times h$

$= 3\pi y^2 h$

$36\pi y^3 = 3\pi y^2 h$

$36y = 3h$

$12y = h$

h = $12y$ **(5)**