Area & Volume (Q 1, Paper 2)

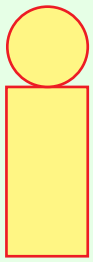
Lesson No. 3: Surface Area & Volume of Regular Shapes

2007

1 (c) A team trophy for the winners of a football match is in the shape of a sphere supported on a cylindrical base, as shown. The diameter of the sphere and of the cylinder is 21 cm.

(i) Find the volume of the sphere, in terms of π.

(ii) The volume of the trophy is 6174π cm^3.
Find the height of the cylinder.



2006

1 (c) (i) The volume of a hemisphere is 486π cm^3.
Find the radius of the hemisphere.

(ii) Find the volume of the smallest rectangular box that the hemisphere will fit into.

2005

1 (c) A steel-works buys steel in the form of solid cylindrical rods of radius 10 centimetres and length 30 metres.
The steel rods are melted to produce solid spherical ball-bearings. No steel is wasted in the process.

(i) Find the volume of steel in one cylindrical rod, in terms of π.

(ii) The radius of a ball-bearing is 2 centimetres.
How many such ball-bearings are made from one steel rod?

(iii) Ball-bearings of a different size are also produced.
One steel rod makes 225 000 of these new ball-bearings.
Find the radius of the new ball-bearings.

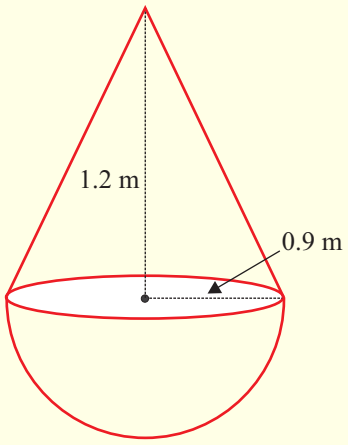
2004

1 (c) A buoy at sea is in the shape of a hemisphere with a cone on top, as in the diagram.
The radius of the base of the cone is 0.9m and its vertical height is 1.2 m.

(i) Find the vertical height of the buoy.

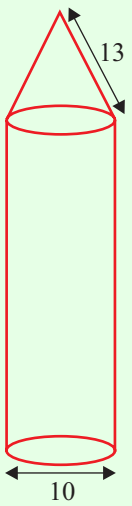
(ii) Find the volume of the buoy, in terms of π.

(iii) When the buoy floats, 0.8 m of its height is above water. Find, in terms of π, the volume of that part of the buoy that is above the water.



2003

1 (c) A wax crayon is in the shape of a cylinder of diameter 10 mm, surmounted by a cone of slant height 13 mm.



(i) Show that the vertical height of the cone is 12 mm.

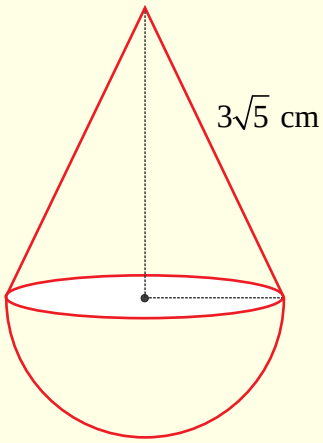
(ii) Show that the volume of the cone is 100π mm^3.

(iii) Given that the volume of the cylinder is 15 times the volume of the cone, find the volume of the crayon, in cm^3, correct to two decimal places.

(iv) How many complete crayons like this one can be made from 1 kg of wax, given that each cm^3 of wax weighs 0.75 grammes?

2002

1 (c) A solid is in the shape of a hemisphere surmounted by a cone, as in the diagram.



(i) The volume of the hemisphere is 18π cm^3.
Find the radius of the hemisphere.

(ii) The slant height of the cone is $3\sqrt{5}$ cm.
Show that the vertical height of the cone is 6 cm.

(iii) Show that the volume of the cone equals the volume of the hemisphere.

(iv) This solid is melted down and recast in the shape of a solid cylinder.
The height of the cylinder is 9 cm. Calculate its radius.

2001

1 (c) Sweets, made from a chocolate mixture, are in the shape of solid spherical balls.
The diameter of each sweet is 3 cm.
36 sweets fit exactly in a rectangular box which has internal height 3 cm.

(i) The base of the box is a square. How many sweets are there in each row?

(ii) What is the internal volume of the box?

(iii) The 36 sweets weigh 675 grammes.
What is the weight of 1 cm^3 of the chocolate mixture? Give your answer correct to one decimal place.

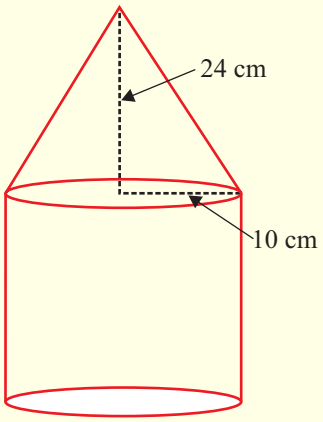
2000

1 (c) A candle is in the shape of a cylinder surmounted by a cone, as in the diagram.

(i) The cone has height 24 cm and the length of the radius of its base is 10 cm.
Find the volume of the cone in terms of π.

(ii) The height of the cylinder is equal to the slant height of the cone.
Find the volume of the cylinder in terms of π.

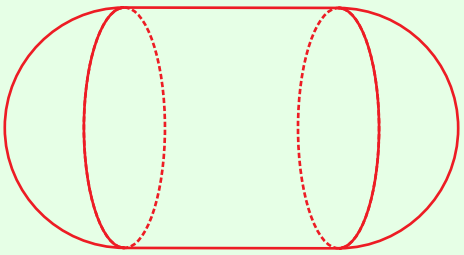
(iii) A solid spherical ball of wax with radius of length r cm was used to make the candle.
Calculate r, correct to one decimal place.



1999

1 (c) (i) Write down, in terms of π and r, the volume of a hemisphere with radius of length r.

(ii) A fuel storage tank is in the shape of a cylinder with a hemisphere at each end, as shown.



The capacity (internal volume) of the tank is 81π m^3.
The ratio of the capacity of the cylindrical section to the sum of the capacities of the hemispherical ends 5:4.

Calculate the internal radius length of the tank.

1998

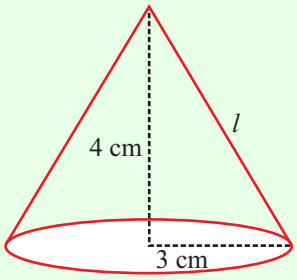
1 (c) Find the volume of a solid sphere with a diameter of length 3 cm. Give your answer in terms of π.

A cylindrical vessel with internal diameter of length 15 cm contains water. The surface of the water is 11 cm from the top of the vessel.

How many solid spheres, each with diameter of length 3 cm, must be placed in the vessel in order to bring the surface of the water to 1 cm from the top of the vessel?
Assume that all the spheres are submerged in the water.

1997

1 (a) Find the slant height, l, of a cone which has perpendicular height of 4 cm and base with radius of length 3 cm.
Write down the curved surface area of the cone in terms of π.



1 (c) Find the volume of a solid sphere which has radius of length 2.1 cm. Give your answer correct to the nearest cm^3. Take $\frac{22}{7}$ as an approximation of π.

This sphere and a solid cube with edge of length 3 cm are completely submerged in water in a cylinder. The cylinder has radius of length r cm.

Both the sphere and the cube are then removed from the cylinder. The water level drops by 4 cm. Find r, correct to one place of decimals. [Take $\pi = \frac{22}{7}$.]

1996

1 (c) A solid cylinder, made of lead, has a radius of length 15 cm and height of 135 cm. Find its volume in terms of π.

The solid cylinder is melted down and recast to make four identical right circular solid cones. The height of each cone is equal to twice the length of its base radius.

Calculate the base radius length of the cones.

Answers

2007 1 (c) (i) 1543.5π cm^3 (ii) 42 cm

2006 1 (c) (i) 9 cm (ii) 2916 cm^3

2005 1 (c) (i) $300,000\pi$ cm^3 (ii) 28,125 (iii) 1 cm

2004 1 (c) (i) 2.1 m (ii) $0{\cdot}81\pi$ m^3 (iii) $0{\cdot}096\pi$ m^3

2003 1 (c) (iii) 5.03 cm^3 (iv) 265

2002 1 (c) (i) 3 cm (iv) 2 cm

2001 1 (c) (i) 6 (ii) 972 cm^2 (iii) 1.3 g

2000 1 (c) (i) 800π cm^3 (ii) 2600π cm^3 (iii) 13.7 cm

1999 1 (c) (i) $\frac{2}{3}\pi r^3$ (ii) 3 cm

1998 1 (c) $\frac{9}{2}\pi$ cm^3, 125

1997 1 (a) 5 cm, 15π cm^2
(c) 39 cm^3, 2.3 cm

1996 1 (c) $30,375\pi$ cm^3; $22{\cdot}5$ cm