



MATHS

NCERT - NCERT

MATHEMATICS(ENGLISH)

SURFACE AREAS AND VOLUMES

Exercise 13 4

1. A drinking glass is in the shape of a frustum of a cone of height 14 cm. The diameters of its

two circular ends are 4 cm and 2 cm. Find the capacity of the glass.



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2. A fez, the cap used by the Turks, is shaped like the frustum of a cone. If its radius on the open side is 10 cm, radius at the upper base is 4 cm and its slant height is 15 cm, find the area of material used for making it.



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3. The slant height of a frustum of a cone is 4 cm and the perimeters (circumference) of its circular ends are 18 cm and 6 cm. Find the curved surface area of the frustum.



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4. A metallic right circular cone 20 cm high and whose vertical angle is 60° is cut into two parts at the middle of its height by a plane parallel to its base. If the frustum so obtained

be drawn into a wire of diameter $\frac{1}{16} \text{ cm}$ find the length of the wire.



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5. a container open at the top and made up of a metal sheet, is in the form of a frustum of a cone of height 14 cm with radii of its lower and upper circular ends as 6 cm and 21 cm, respectively. find the capacity of the container.



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Exercise 13 1

1. A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 13 cm. Find the inner surface area of the vessel.



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2. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius.

The total height of the toy is 15.5 cm. Find the total surface area of the toy.



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3. 2 cubes each of volume 64cm^3 are joined end to end. Find the surface area of the resulting cuboid.



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4. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm. Find its surface area.



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5. A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are 2.1 m and 4

m respectively, and the slant height of the top is 2.8 m, find the area of the canvas used for making the tent. Also find the rate of the canvas with 500 per m^2



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6. A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have? Find the surface area of the solid.



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7. A hemispherical depression is cut out from one face of a cubical wooden block such that the diameter l of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.



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8. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed

out. Find the total surface area of the remaining solid to the nearest cm^2



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9. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the total surface area of the article.



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Exercise 13 5

1. Derive the formula for the curved surface area and total surface area of the frustum of a cone.



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2. In one fortnight of a given month, there was a rainfall of 10 cm in a river valley. If the area of the valley is 97280 km^2 , show that the total rainfall was approximately equivalent to the

addition to the normal water of three rivers
each 1072 km long, 75 m wide and 3m deep



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3. An oil funnel made of tin sheet consists of a 10 cm long cylindrical portion attached to a frustum of a cone. If the total height is 22 cm, diameter of the cylindrical portion is 8 cm and the diameter of the top of the funnel is 18 cm, find the area of the tin sheet required to make the funnel.



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4. A right triangle, whose sides are 3 cm and 4 cm (other than hypotenuse) is made to revolve about its hypotenuse. Find the volume and surface area of the double cone so formed.



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5. A cistern, internally measuring $150\text{ cm} \times 120\text{ cm} \times 110\text{ cm}$ has 129600 cm^3 of water in it. Porous bricks are placed in the

water until the cistern is full to the brim. Each brick absorbs one seventeenth of its own volume of water. How many bricks can be put in without the water overflowing, each brick being $22.5\text{ cm} \times 7.5\text{ cm} \times 6.5\text{ cm}$?



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6. A copper wire, 3 mm in diameter, is wound about a cylinder whose length is 12 cm , and diameter 10 cm , so as to cover the curved surface of the cylinder. Find the length and

mass of the wire, assuming the density of copper to be 8.88 g per cm^3



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7. Derive the formula for the volume of the frustum of a cone.



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Solved Examples

1. Selvis house has an overhead tank in the shape of a cylinder. This is filled by pumping water from a sump (an underground tank) which is in the shape of a cuboid. The sump has dimensions $1.57m \times 1.44m \times 95cm$. The overhead tank has its radius



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2. A cone of height 24 cm and radius of base 6 cm is made up of modelling clay. A child

reshapes it in the form of a sphere. Find the radius of the sphere.



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3. Rasheed got a playing top (lattu) as his birthday present, which surprisingly had no colour on it. He wanted to colour it with his crayons. The top is shaped like a cone surmounted by a hemisphere. The entire top is 5 cm in height and the diameter of the top is 3.5 cm. Find the area he has to colour.



4. A wooden toy rocket is in the shape of a cone mounted on a cylinder. The height of the entire rocket is 26 cm, while the height of the conical part is 6 cm. The base of the conical portion has a diameter of 5 cm, while the base diameter of the cylindrical portion is 3 cm. If the conical portion is to be painted orange and the cylindrical portion yellow, find the area of the rocket painted with each of these colours.

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5. The decorative block shown in Fig. 13.7 is made of two solids — a cube and a hemisphere. The base of the block is a cube with edge 5 cm, and the hemisphere fixed on the top has a diameter of 4.2 cm. Find the total surface area of the block.

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6. Shanta runs an industry in a shed which is in the shape of a cuboid surmounted by a half cylinder. If the base of the shed is of dimension $7m \times 15m$, and the height of the cuboidal portion is 8 m, find the volume of air that the shed can hold. Further suppose the machinery in the shed occupies $300 m^3$ and 20 workers each of whom occupy $0.08 m^3$ space on an average. Then how much air is in the shed.



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7. Mayank made a bird-bath for his garden in the shape of a cylinder with a hemispherical depression at one end. The height of the cylinder is 1.45 m and its radius is 30 cm. Find the total surface area of the bird-bath.



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8. A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm and the diameter of

the base is 4 cm. Determine the volume of the toy. If a right circular cylinder circumscribes the toy, find the difference of the volumes of the cylinder and the toy.



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9. A juice seller was serving his customers using glasses. The inner diameter of the cylindrical glass was 5 cm, but the bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass. If the

height of a glass was 10 cm, find the apparent capacity of the glass and its actual capacity.



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10. An open metal bucket is in the shape of a frustum of a cone, mounted on a hollow cylindrical base made of the same metallic sheet. The diameters of the two circular ends of the bucket are 45 cm and 25 cm, the total vertical height of the bucket is 40cm and that of the cylindrical base is 6cm. Find the area of

the metallic sheet used to make the bucket, where we do not take into account the handle of the bucket. Also, find the volume of water the bucket can hold. (Take $\pi=22/7$)



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11. The radii of the ends of a frustum of a cone 45 cm high are 28 cm and 7 cm. Find its volume, the curved surface area and the total surface area.



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12. Hanumappa and his wife Gangamma are busy making jaggery out of sugarcane juice. They have processed the sugarcane juice to make the molasses, which is poured into moulds in the shape of a frustum of a cone having the diameters of its two circular faces as 30 cm and 35 cm and the vertical height of the mould is 14 cm (see Fig. 13.22). If each cm^3 of molasses has mass about 1.2 g, find the mass of the molasses that can be poured into each mould. (Take $\pi = \frac{22}{7}$)



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13. A copper rod of diameter 1 cm and length 8 cm is drawn into a wire of length 18 m of uniform thickness. Find the thickness of the wire.



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14. A hemispherical tank full of water is emptied by a pipe at the rate of $\frac{25}{7}$ litres per

second. How much time will it take to empty half the tank, if it is 3m in diameter?



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Exercise 13 2

1. A spherical glass vessel has a cylindrical neck 8 cm long, 2 cm in diameter; the diameter of the spherical part is 8.5 cm. By measuring the amount of water it holds, a child finds its volume to be 345 cm^3 . Check whether she is

correct, taking the above as the inside measurements.



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2. A solid consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm is placed upright in a right circular cylinder full of water such that it touches the bottom. Find the volume of water left in the cylinder, if the radius of the cylinder is 60 cm and its height is 180 cm.



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3. A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, which is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8g mass.



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4. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.



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5. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand.



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6. A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately

how much syrup would be found in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm.



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7. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its length is 12 cm. If each

cone has a height of 2 cm, find the volume of air contained in the model that Rachel made. (Assume the outer and inner dimensions of the model to be nearly the same.)



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8. A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π .



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Exercise 13.3

1. A well of diameter 3 m is dug 14 m deep. The earth taken out of it has been spread evenly all around it in the shape of a circular ring of width 4 m to form an embankment. Find the height of the embankment.



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2. A container shaped like a right circular cylinder having diameter 12 cm and height 15 cm is full of ice cream. The ice cream is to be filled into cones of height 12 cm and diameter 6 cm, having a hemispherical shape on the top. Find the number of such cones which can be filled with ice cream.



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3. How many silver coins, 1.75 cm in diameter and of thickness 2 mm , must be melted to form a cuboid of dimensions $5.5\text{ cm} \times 10\text{ cm} \times 3.5\text{ cm}$?



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4. A cylindrical bucket, 32 cm high and with radius of base 18 cm , is filled with sand. This bucket is emptied on the ground and a conical heap of sand is formed. If the height of the

conical heap is 24 cm, find the radius and slant height of the heap.



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5. A metallic sphere of radius 4.2 cm is melted and recast into the shape of a cylinder of radius 6 cm. Find the height of the cylinder.



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6. Metallic spheres of radii 6 cm, 8 cm and 10 cm, respectively, are melted to form a single solid sphere. Find the radius of the resulting sphere.



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7. A 20 m deep well with diameter 7 m is dug and the earth from digging is evenly spread out to form a platform 22 m by 14 m. Find the height of the platform.



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8. Water in a canal, 6 m wide and 1.5 m deep, is flowing with a speed of 10 km/h . How much area will it irrigate in 30 minutes, if 8 cm of standing water is needed?

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9. A farmer connects a pipe of internal diameter 20 cm from a canal into a cylindrical tank in her field, which is 10 m in diameter and

2 m deep. If water flows through the pipe at the rate of 3 km/h, in how much time will the tank be filled?



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