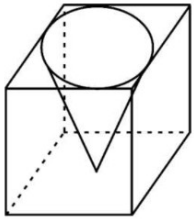
12. Surface Areas and Volumes - Board Exam Questions

The detailed solution for all the questions can be found at pschool.in/math/ncert/g10/chap-12

1 Mark Questions (MCQ)

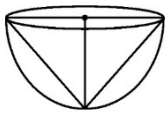
1) The total surface area of a solid hemisphere of diameter '2d' is:
2) A hemispherical bowl is made of steel of thickness 1 cm. The outer radius of the bowl is 6 cm. The volume of steel used (in cm^3) is:
3) A cone of maximum size is carved out from a solid cube of edge length l. The volume of the cone is:



4) Three tennis balls are just packed in a cylindrical jar. If radius of each ball is r, volume of air inside the jar is



5) An ice-cream cone of radius r and height h is completely filled by two spherical scoopes of ice-cream. If radius of each spherical scoop is $\frac{r}{2}$, then h : 2r equals
6) A conical cavity of maximum volume is carved out from a wooden solid hemisphere of radius 10 cm. Curved surface area of the cavity carved out is (use π = 3.14)



7) A camping tent in hemispherical shape of radius 1.4 m, has a door opening of area 0.50 m^2. Outer surface area of the tent is
8) Two cubes each of volume 64 cm^3 are joined end to end to form a solid. The surface area of the resultant cuboid is:
9) If the volumes of two cubes are in the ratio 8 : 125, then the ratio of their surface areas is:

10) On the top face of the wooden cube of side 7 cm, hemispherical depressions of radius 0.35 cm are to be formed by taking out the wood. The maximum number of depressions that can be formed is:

11) A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is

12) If a cone of greatest possible volume is hollowed out from a solid wooden cylinder, then the ratio of the volume of remaining wood to the volume of cone hollowed out is

13) If the area of the base of a right circular cone is 51 cm^2 and its volume is 85 cm^3, then the height of the cone is given as

14) A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is:

15) The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is:

16) The ratio of total surface area of a solid hemisphere to the square of its radius is:

17) The radius of the base of a right circular cone and the radius of a sphere are each 5 cm in length. If the volume of the cone is equal to the volume of the sphere then the height of the cone is

18) The volume of a solid hemisphere is $\frac{396}{7}$ cm^3. The total surface area of the solid hemisphere (in sq. cm) is

19) Curved surface area of a cylinder of height 5 cm is 94.2 cm^2. Radius of the cylinder is (Take $\pi = 3.14$)

20) The curved surface area of a cone having height 24 cm and radius 7 cm, is

21) What is the total surface area of a solid hemisphere of diameter 'd'?

22) Water in a river which is 3 m deep and 40 m wide is flowing at the rate of 2 km/h. How much water will fall into the sea in 2 minutes?

23) The volume of a right circular cone whose area of the base is 156 cm^2 and the vertical height is 8 cm, is

24) The sum of the length, breadth and height of a cuboid is $6\sqrt{3}$ cm and the length of its diagonal is $2\sqrt{3}$ cm. The total surface area of the cuboid is

Assertion and Reason

1) ASSERTION (A): The surface area of the cuboid formed by joining two cubes of sides 4 cm each, end-to-end, is 160 cm^2.
REASON (R): The surface area of a cuboid of dimensions l × b × h is (lb + bh + hl).

2) ASSERTION (A): If we join two hemispheres of same radius along their bases, then we get a sphere.
REASON (R): Total Surface Area of a sphere of radius r is $3\pi r^2$.

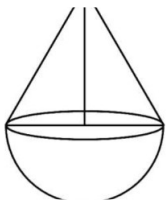
3) ASSERTION (A): Two cubes each of edge length 10 cm are joined together. The total surface area of newly formed cuboid is 1200 cm^2.
REASON (R): Area of each surface of a cube of side 10 cm is 100 cm^2.

4) ASSERTION (A): Total Surface area of the top is the sum of the curved surface area of the hemisphere and the curved surface area of the cone.
REASON (R): Top is obtained by joining the plane surfaces of the hemisphere and cone together.



2 Mark Questions

1) A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy.



3 Mark Questions

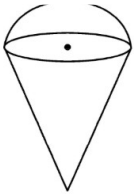
1) A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. (Use $\pi = \frac{22}{7}$)

2) A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\frac{1408}{21}\ \mathrm{m}^3$ of air, find the height of the cylindrical part. (Use $\pi = \frac{22}{7}$)

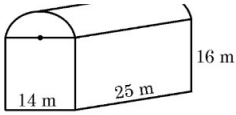
3) A room is in the form of cylinder surmounted by a hemi-spherical dome. The base radius of hemisphere is one-half the height of cylindrical part. Find total height of the room if it contains $\left(\frac{1408}{21}\right)\ \mathrm{m}^3$ of air. $\left(\text{Take } \pi = \frac{22}{7}\right)$

4) The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is $176\ \mathrm{cm}^3$, find the outer and inner radii of the cylinder.

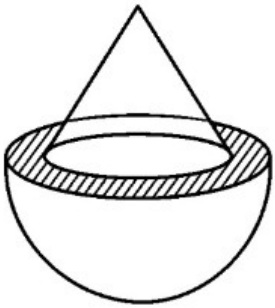
5) An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $\left(\frac{1}{6}\right)^{\text{th}}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find volume of the ice-cream. (Take $\pi = 3.14$)



6) To protect plants from heat, a shed of iron rods covered with green cloth is made. The lower part of the shed is a cuboid mounted by semi-cylinder as shown in the figure. Find the area of the cloth required to make this shed, if dimensions of the cuboid are $14\ \mathrm{m} \times 25\ \mathrm{m} \times 16\ \mathrm{m}$

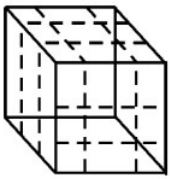


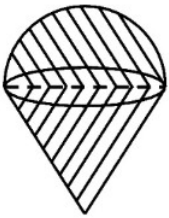
7) The internal and external radii of a hollow hemisphere are $5\sqrt{2}$ cm and 10 cm respectively. A cone of height $5\sqrt{7}$ cm and radius $5\sqrt{2}$ cm is surmounted on the hemisphere as shown in the figure. Find the total surface area of the object in terms of π. (Use $\sqrt{2} = 1.4$)



4 Mark Questions

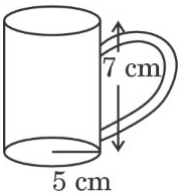
1) On a Sunday your parents took you to a fair. You could see lot of toys displayed and you wanted them to buy a Rubik's cube and a strawberry ice-cream for you.





(i) Find the length of the diagonal of Rubik's cube if each edge measures 6 cm. (1)
(ii) Find the volume of Rubik's cube if the length of the edge is 7 cm. (1)
(iii) (a) What is the curved surface area of hemisphere (ice-cream) if the base radius is 7 cm? (2)
OR (b) If two cubes of edges 4 cm are joined end-to-end, then find the surface area of the resulting cuboid.

2) Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals. 500 mL milk is packed in a cuboidal container of dimensions $15 \text{ cm} \times 8 \text{ cm} \times 5 \text{ cm}$. These milk packets are then packed in cuboidal cartons of dimensions



$30 \text{ cm} \times 32 \text{ cm} \times 15 \text{ cm}$.

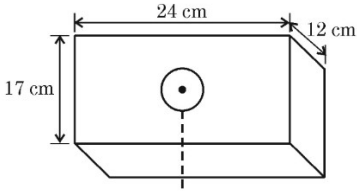
(i) Find the volume of the cuboidal carton. (1)

(ii) (a) Find the total surface area of a milk packet. (2)

OR (b) How many milk packets can be filled in a carton?

(iii) How much milk can the cup (as shown in the figure) hold? (1)

3) A wall mounted lamp, made of fabric, is shown below. Lamp has cuboidal shape, open from top and bottom. A spherical bulb of diameter 7 cm is latched with a very thin rod. (Ignore the rod while making calculations.) Dimensions of the cuboid are $24 \text{ cm} \times 12 \text{ cm} \times 17 \text{ cm}$.



(i) Find the surface area of the bulb. (1)

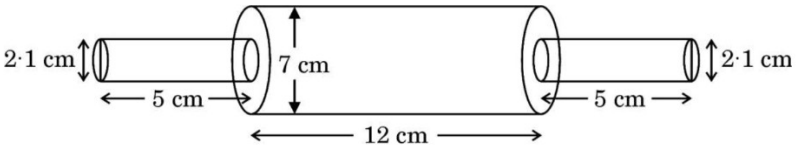
(ii) What could be the maximum diameter of the bulb if at least 1 cm space is left from each side? (1)

(iii) (a) Find the area of the fabric used if there is a fold of 2 cm on top and bottom edges. (2)

OR (b) Find the space available inside the lamp.

4) A skilled carpenter decided to craft a special rolling pin for the local baker. He carefully joined three cylindrical pieces of wood – two small ones on the ends and one larger in the centre to create a perfect tool. The baker loved the rolling pin, as it rolled out the smoothest dough for breads and pastries.

The length of the bigger cylindrical part is 12 cm and diameter is 7 cm and the length of each smaller cylindrical part is 5 cm and diameter is 2.1 cm.



(i) Find the volume of the bigger cylindrical part. (1)

(ii) Find the curved surface area of the bigger cylindrical part. (1)

(iii) (a) Find the ratio of the volume of the bigger cylindrical part to the total volume of the two smaller (identical) cylindrical

parts. (2)
OR (b) Find the sum of the curved surface areas of the two identical smaller cylindrical parts.

5) In a coffee shop, coffee is served in two types of cups. One is cylindrical in shape with diameter 7 cm and height 14 cm and the other is hemispherical with diameter 21 cm.



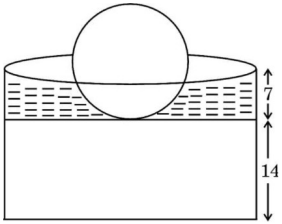
(i) Find the area of the base of the cylindrical cup. (1)
(ii) (a) What is the capacity of the hemispherical cup? (2)
OR (b) Find the capacity of the cylindrical cup.
(iii) What is the curved surface area of the cylindrical cup? (1)

6) Metallic silos are used by farmers for storing grains. Farmer Girdhar has decided to build a new metallic silo to store his harvested grains. It is in the shape of a cylinder mounted by a cone.
Dimensions of the conical part of a silo: radius of base $1.5\ \mathrm{m}$, height $2\ \mathrm{m}$.
Dimensions of the cylindrical part of a silo: radius $1.5\ \mathrm{m}$, height $7\ \mathrm{m}$.
(i) Calculate the slant height of the conical part of one silo. (1)
(ii) Find the curved surface area of the conical part of one silo. (1)
(iii) Find the cost of metal sheet used to make the curved cylindrical part of 1 silo at the rate of ₹2000 per m^2. (2)
OR Find the total capacity of one silo to store grains.

7) The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd.
A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m.
(i) Find slant height of the conical part. (1)
(ii) Determine the floor area of the tent. (1)

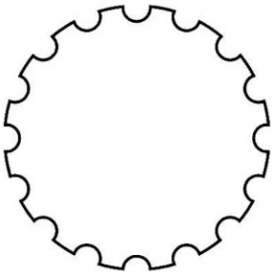
(iii) (a) Find area of the cloth used for making tent. (2)
OR (b) Find total volume of air inside an empty tent.

8) A model of Leafy Ball Fountain is made to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled.
The diameter of spherical ball is 21 cm.
Cylindrical pool – Outer diameter is 50 cm and inner diameter is 40 cm. Height of solid
base is 14 cm. Height of water filled is 7 cm.



(i) Determine the total height of the fountain. (1)
(ii) Find the volume of the ball. (1)
(iii) (a) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool. (2)
OR (b) Find the sum of the outer curved surface area of the cylindrical part and surface area of the ball.

9) A golf ball is spherical with about 300 – 500 dimples that help increase its velocity while in play. Golf balls are traditionally white but available in colours also. In the given figure, a golf ball has diameter 4.2 cm and the surface has 315 dimples (hemi-spherical) of radius 2 mm.



(i) Find the surface area of one such dimple. (1)
(ii) Find the volume of the material dug out to make one dimple. (1)
(iii) (a) Find the total surface area exposed to the surroundings. (2)
OR (b) Find the volume of the golf ball.

5 Mark Questions

1) A tent is in the shape of a cylinder surmounted by a conical top. If the height and radius of the cylindrical part are 3 m and 14 m respectively, and the total height of the tent is 13.5 m, then find the area of the canvas required for making the tent, keeping a provision of $26\ \mathrm{m}^2$ of canvas for stitching and wastage. Also, find the cost of the canvas to be purchased at the rate of ₹250 per m^2.

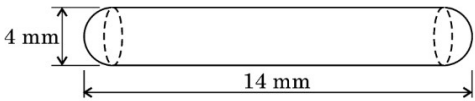
2) A tent is in the shape of a cylinder surmounted by a conical top. If the height and radius of the cylindrical part are 3 m and 14 m respectively, and the total height of the tent is 13.5 m, find the area of the canvas required for making the tent, keeping a provision of $26\ \mathrm{m}^2$ of canvas for stitching and wastage. Also, find the cost of the canvas to be purchased at the rate of ₹500 per m^2.

3) Due to heavy floods in a state, thousands were rendered homeless. 50 schools collectively decided to provide place and the canvas for 1500 tents and share the whole expenditure equally. The lower part of each tent is cylindrical with base radius 2.8 m and height 3.5 m and the upper part is conical with the same base radius, but of height 2.1 m. If the canvas used to make the tents costs ₹120 per m^2, find the amount shared by each school to set up the tents.

4) A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.

5) A solid wooden toy is in the form of a hemisphere surmounted by a cone of the same radius. The radius of hemisphere is 3.5 cm and the total wood used in making the toy is $166\frac{5}{6}\ \mathrm{cm}^3$. Find the height of the conical part. Also, find the cost of painting the hemispherical part of the toy at the rate of ₹15 per cm^2.

6) 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 4 mm, find its surface area. Also, find



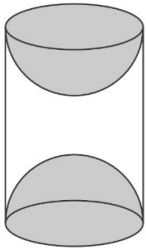
its volume.

7) A student was asked to make a model shaped like a cylinder with two cones attached to its ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its total length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model.

8) A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that $1\ \text{cm}^3$ of iron has approximately $8\ \text{g}$ mass.

9) An empty cone of radius 3 cm and height 12 cm is filled with ice-cream such that the lower part of the cone which is $\left(\frac{1}{6}\right)$th of the volume of the cone is unfilled (empty) but a hemisphere is formed on the top. Find the volume of the ice-cream.

10) A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 5.8 cm and its base is of radius 2.1 cm, find the total surface area of the article.



11) From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid.

12) From one face of a solid cube of side 14 cm, the largest possible cone is carved out. Find the volume and surface area of the remaining solid. (Use $\pi = \frac{22}{7}$, $\sqrt{5} = 2.2$)

13) From a solid right circular cone, whose height is 6 cm and radius of base is 12 cm, a right circular cylindrical cavity of height 3 cm and radius 4 cm is hollowed out such that bases of cone and cylinder form concentric circles. Find the surface area of the remaining solid in terms of π.

14) A wooden cubical die is formed by forming hemispherical

depressions on each face of the cube such that face 1 has one depression, face 2 has two depressions and so on. The sum of number of hemispherical depressions on opposite faces is always 7. If the edge of the cubical die measures 5 cm and each hemispherical depression is of diameter 1.4 cm, find the total surface area of the die so formed.

15) From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.

16) There are two identical solid cubical boxes of side 7 cm. From the top face of the first cube a hemisphere of diameter equal to the side of the cube is scooped out. This hemisphere is inverted and placed on the top of the second cube's surface to form a dome. Find
(i) the ratio of the total surface area of the two new solids formed
(ii) volume of each new solid formed.

17) 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.

18) Water is flowing at the rate of 15 km/h through a pipe of diameter 14 cm into a cuboidal pond which is 50 m long and 44 m wide. In what time will the level of water in pond rise by 21 cm? What should be the speed of water if the rise in water level is to be attained in 1 hour?