

Surface Areas and Volumes

Previous Years' CBSE Board Questions

12.1 Introduction

MCQ

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

- (a) 528 cm^2
- (b) 1056 cm^2
- (c) 550 cm^2
- (d) 500 cm^2 (2023)

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

- (a) 2 cm
- (b) 3 cm
- (c) 2.9 cm
- (d) 6 cm (2023)

3. A solid spherical ball fits exactly inside the cubical box of side $2a$. The volume of the ball is

- (a) $\frac{16}{3}\pi a^3$ (b) $\frac{1}{6}\pi a^3$ (c) $\frac{32}{3}\pi a^3$ (d) $\frac{4}{3}\pi a^3$
- (2020 C)

4. The radius of a sphere (in cm) whose volume is $12\pi \text{ cm}^3$, is

- (a) 3
- (b) $3\sqrt{3}$
- (c) $3^{2/3}$
- (d) $3^{1/3}$ (2020)

5. A rectangular sheet of paper 40 cm x 22 cm, is rolled to form a hollow cylinder of height 40 cm. The radius of the cylinder (in cm) is

- (a) 3.5 (b) 7
(c) $\frac{80}{7}$ (d) 5 (Foreign 2014)

VSA (1 mark)

6. Two cones have their heights in the ratio 1:3 and radii in the ratio 3: 1. What is the ratio of their volumes? (2020)

7. Volume and surface area of a solid hemisphere are numerically equal. What is the diameter of hemisphere? (Delhi 2017)

SAI (2 marks)

8. How many cubes of side 2 cm can be made from a solid cube of side 10 cm? (2020)

9. A cone and a cylinder have the same radii but the height of the cone is 3 times that of the cylinder. Find the ratio of their volumes. (2020)

10. If the total surface area of a solid hemisphere is 462 cm^2 , find its volume. $\left[\text{Take } \pi = \frac{22}{7} \right]$ (AI 2014)

SA II (3 marks)

11. The radius of the base and the height of a solid right circular cylinder are in the ratio 2:3 and its volume is 1617 cm^3 . Find the total surface area of the cylinder.

$\left[\text{Take } \pi = \frac{22}{7} \right]$ (Term II, 2021-22C)

12. A heap of rice is in the form of a cone of base diameter 24 m and height 3.5 m. Find the volume of the rice. How much canvas cloth is required to just cover the heap? (2018)

13. The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the cylinder is 1628 sq. cm, find the volume of

the cylinder. $\left(\text{Use } \pi = \frac{22}{7} \right)$ (Delhi 2016)

14. A right circular cone of radius 3 cm, has a curved surface area of 47.1 cm^2 . Find the volume of the cone.

(Use $\pi = 3.14$) (Delhi 2016)

15. A 5 m wide cloth is used to make a conical tent of base diameter 14 m and height 24 m. Find the cost of

cloth used at the rate of ₹ 25 per metre. $\left[\text{Use } \pi = \frac{22}{7} \right]$
(Foreign 2014)

LA (4/5/6 marks)

16. Case Study: John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items they decided the following dimensions: Cake Cylindrical shape with diameter 24 cm and height 14 cm.
Cap: Conical shape with base circumference 44 cm and height 24 cm.



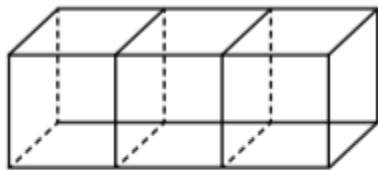
Based on the above information answer the following questions.

- (a) How many square cm paper would be used to make 4 such caps?
- (b) The bakery shop sells cakes by weight (0.5 kg, 1 kg, 1.5 kg, etc.). To have the required dimensions how much cake should they order if 650 cm^3 equals 100 g of cake? (Term II, 2021-22)

12.2 Surface Area of a Combination of Solids

SA II (3 marks)

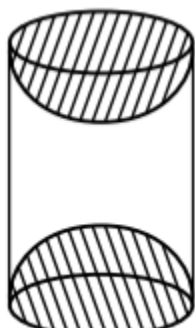
17. Three cubes of side 6 cm each, are joined as shown in given figure. Find the total surface area of the resulting cuboid.



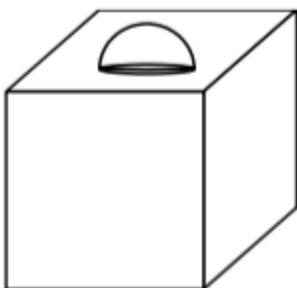
(Term II, 2021-22)

18. Two cones with same base diameter 16 cm and height 15 cm are joined together along their bases. Find the surface area of the shape so formed. (2019 C)

19. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in figure. 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.



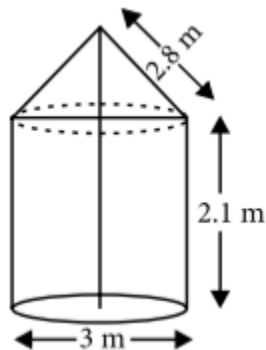
20. In the given figure, there is a decorative block, made up of two solids a cube and a hemisphere. The base of the block is a cube of side 6 cm and the hemisphere fixed on the top has a diameter of 3.5 cm. Find the total surface area of the



block. (Use $\pi = \frac{22}{7}$)

(Delhi 2016)

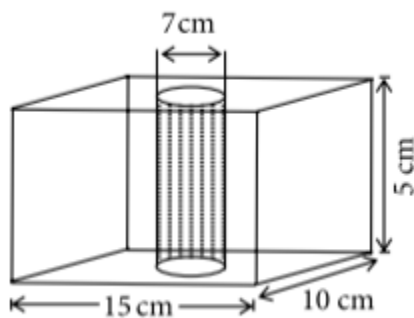
22. In the given figure, a tent is in the shape of a cylinder surmounted by a conical top of same diameter. If the height and diameter of cylindrical part are 2.1 m and 3 m respectively and the slant height of conical part is 2.8 m, find the cost of canvas needed to make the tent if the canvas is available at the



rate of ₹500/sq. metre. $\left(\text{Use } \pi = \frac{22}{7} \right)$ (AI 2016)

23. In the given figure, from a cuboidal solid metallic block, of dimensions 15 cm x 10 cm x 5 cm, a cylindrical hole of diameter 7 cm is drilled out. Find the surface area of the remaining block.

$\left[\text{Use } \pi = \frac{22}{7} \right]$



(Delhi 2015,

24. Due to sudden floods, some welfare associations jointly requested the government to get 100 tents fixed immediately and offered to contribute 50% of the cost. If the lower part of each tent is of the form of a cylinder of diameter 4.2 m and height 4 m with the conical upper part of same diameter but of height 2.8 m, and the canvas to be used costs 100 per sq. m, find the amount,

the associations will have to pay. What values are shown by these associations? $\left[\text{Use } \pi = \frac{22}{7} \right]$ (AI 2015)

25. A cubical block of side 10 cm is surmounted by a hemisphere. What is the largest diameter that the hemisphere can have? Find the cost of painting the total surface area of the solid so formed, at the rate of Rs.5 per 100 sq. cm [Use $\pi = 3.14$]. (AI 2015)

LA (4/5/6 marks)

26. 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 10 cm and its base is of radius 3.5 cm, find the total surface area of the article. (2023)



27. Case Study: A 'circus' is a company of performers who put on shows of acrobats, clowns etc. to entertain people started around 250 years back, in open fields, now generally performed in tents. One such 'Circus Tent' is shown below.



The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find

- (i) the area of the canvas used in making the tent.
 (ii) the cost of the canvas bought for the tent at the rate 200 per sq. m, if 30 sq. m canvas was wasted during stitching. (Term II, 2021-22)
28. From a solid cylinder of height 2.8 cm and diameter 4.2 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area

of the remaining solid. $\left[\text{Take } \pi = \frac{22}{7} \right]$ (Delhi 2014)

29. A hemispherical depression is cut out from one face of a cubical block of side 7 cm, such that the diameter of the hemisphere is equal to the edge of the cube. Find

the surface area of the remaining solid. $\left[\text{Use } \pi = \frac{22}{7} \right]$
 (Foreign 2014)

12.3 Volume of a Combination of Solids

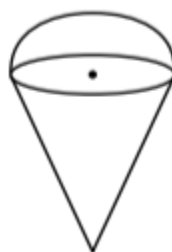
SA II (3 marks)

30. 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

$\left(\frac{1408}{21} \right) \text{ m}^3$ of air. $\left(\text{Take } \pi = \frac{22}{7} \right)$ (2023)

31. 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 $\pi = 3.14$)

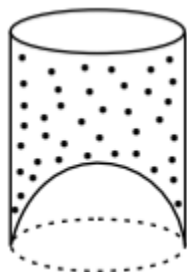


(2023)

32. 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. $\left(\text{Use } \pi = \frac{22}{7} \right)$ (2019)

33. A juice seller was serving his customers using glasses as shown in the given figure. The inner diameter of the cylindrical glass was 5 cm but bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass. If the height of the glass was 10



cm, find the apparent and actual capacity of the glass.

(Use $\pi = 3.14$) (NCERT, AI 2019)

34. A cylindrical tub, whose diameter is 12 cm and height 15 cm is full of ice-cream. The whole ice-cream is to be divided into 10 children in equal ice-cream cones, with conical base surmounted by hemispherical top. If the height of conical portion is twice the diameter of base, find the diameter of conical part of ice-cream cone. (Foreign 2017)

35. A solid wooden toy is in the form of a hemisphere surmounted by a cone of same radius. The radius of hemisphere is 3.5 cm and the total wood used in the

making of toy is $166\frac{5}{6}\text{cm}^3$. Find the height of the toy.

Also, find the cost of painting the hemispherical part of the toy at the rate of 10 per cm^2 . $\left[\text{Use } \pi = \frac{22}{7} \right]$

(Delhi 2015) **An**

36. A metallic cylinder has radius 3 cm and height 5 cm. To reduce its weight, a conical hole is drilled in the

cylinder. The conical hole has a radius of $\frac{3}{2}$ cm and its depth is $\frac{8}{9}$ cm. Calculate the ratio of the volume of

metal left in the cylinder to the volume of metal taken out in conical shape. (Foreign 2015)

37. A solid right-circular cone of height 60 cm and radius 30 cm is dropped in a right-circular cylinder full of water of height 180 cm and radius 60 cm. Find the volume of water left in the cylinder, in cubic metres.

$\left[\text{Use } \pi = \frac{22}{7} \right]$ (Foreign 2015)

38. The largest possible sphere is carved out of a wooden solid cube of side 7 cm. Find the volume of the wood

left. $\left[\text{Use } \pi = \frac{22}{7} \right]$ (AI 2014)

LA (4/5/6 marks)

39. Water is being pumped out through a circular pipe whose internal diameter is 8 cm. If the rate of flow of water is 80 cm/s, then how many litres of water is being pumped out through this pipe in one hour? (2021 C)

40. 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 a platform. Find the height of the platform.

$\left(\text{Take } \pi = \frac{22}{7} \right)$ (2020 C)

41. In Figure-4, 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. (Take $\pi = 3.14$)

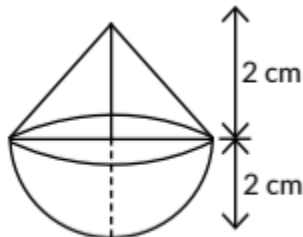


Figure - 4

(2020 C)

42. A solid toy is in the form of a hemisphere surmounted by a right circular cone of same radius. The height of the cone is 10 cm and the radius of the base is 7 cm. Determine the volume of the toy. Also find the area of the coloured sheet required to cover the toy.

(Use $\pi = \frac{22}{7}$ and $\sqrt{149} = 12.2$) (2020)

CBSE Sample Questions

12.1 Introduction

SAI (2 marks)

1. The curved surface area of a right circular cone is 12320 cm^2 . If the radius of its base is 56 cm, then find its height. (Term II, 2021-22)

12.2 Surface Area of a Combination of Solids

MCQ

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

- (a) 48 cm^2
- (b) 72 cm^2
- (c) 96 cm^2
- (d) 108 cm^2 (2022-23)

12.3 Volume of a Combination of Solids

LA II (4/5/6 marks)

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. (2022-23)

4. 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
- the ratio of the total surface area of the two new solids formed.
 - volume of each new solid formed. (2022-23)

SOLUTIONS

Previous Years' CBSE Board Questions

1.

(c): We have, the height of cone, $h = 24$ cm and radius, $r = 7$ cm.

We know, that $l = \sqrt{24^2 + 7^2}$

$$= \sqrt{576 + 49} = 25$$

Now, curved surface area $= \pi r l$

$$= \frac{22}{7} \times 7 \times 25 = 550 \text{ cm}^2$$



2.

(b): Curved surface area of cylinder $= 2\pi rh$

$$\Rightarrow 94.2 = 2 \times 3.14 \times r \times 5$$

$$\Rightarrow r = \frac{94.2}{2 \times 3.14 \times 5}$$

$$\Rightarrow r = 3 \text{ cm}$$

3.

(d): Diameter of sphere = Distance between opposite faces of cube = $2a$

\therefore radius of sphere = a

So, volume of spherical ball = $\frac{4}{3}\pi r^3$

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

4. (c): Let radius of the sphere be r .

According to question, $\frac{4}{3}\pi r^3 = 12\pi$

$$\Rightarrow r^3 = \frac{3 \times 12}{4} = 9 = 3^2 \Rightarrow r = (3^2)^{1/3} = (3)^{2/3} \text{ cm}$$

5. (a): Since rectangular sheet of paper is rolled to form a cylinder of height 40 cm.

\therefore Circumference of base of cylinder = 22 cm

$\Rightarrow 2\pi r = 22$ (where r is radius of cylinder)

$$\Rightarrow 2 \times \frac{22}{7} \times r = 22 \Rightarrow r = \frac{7}{2} = 3.5 \text{ cm}$$

7. Let r be the radius of solid hemisphere.

$$\text{Volume of solid hemisphere} = \frac{2}{3}\pi r^3$$

$$\text{Surface area of solid hemisphere} = 3\pi r^2$$

According to question, $\frac{2}{3}\pi r^3 = 3\pi r^2$

$$\Rightarrow r = 9/2 \text{ units}$$

\therefore Diameter of solid hemisphere = 9 units

8. Let n be the number of solid cubes of side 2 cm made from a solid cube of side 10 cm.

$$\therefore n \times \text{Volume of one small cube} = \text{Volume of big cube}$$

$$\Rightarrow n \times (2)^3 = (10)^3 \Rightarrow 8n = 1000$$

$$\Rightarrow n = \frac{1000}{8} = 125$$

Thus, the number of solid cubes formed of side 2 cm each

9. Let the radius and the height of the cylinder are r and h respectively.

So, radius of the cone is r and height of the cone is 3h.

$$\therefore \text{Volume of the cylinder} = \pi r^2 h$$

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

$$\text{So, required ratio} = \frac{\pi r^2 h}{\pi r^2 h} = 1:1$$

10. Let radius of hemisphere = r cm

$$\text{Total surface area of hemisphere} = 462 \text{ cm}^2$$

$$\Rightarrow 3\pi r^2 = 462 \Rightarrow r^2 = \frac{462 \times 7}{3 \times 22} = 49 \Rightarrow r = 7$$

$$\therefore \text{Volume of hemisphere}$$

$$= \frac{2}{3} \pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 7 \times 7 \times 7 = 718.67 \text{ cm}^3$$

11. Given ratio of radius and height of the right circular cylinder = 2:3

Let radius(r) of the base be 2x and height(h) be 3x.

$$\text{Volume of cylinder, } V = \pi r^2 h$$

$$1617 = \frac{22}{7} \times (2x)^2 \times 3x \quad [\because V = 1617 \text{ cm}^3]$$

$$\Rightarrow 1617 = \frac{22}{7} \times 4x^2 \times 3x$$

$$\Rightarrow \frac{1617 \times 7}{22 \times 4 \times 3} = x^3$$

$$\Rightarrow x^3 = \frac{7 \times 7 \times 7}{2 \times 2 \times 2} \Rightarrow x = \frac{7}{2} \text{ cm.}$$

$$\therefore \text{Radius } r = 2x = \frac{2 \times 7}{2} = 7 \text{ cm}$$

$$\text{and height } h = 3x = \frac{3 \times 7}{2} = \frac{21}{2} \text{ cm}$$

$$\text{Total surface area of cylinder} = 2\pi r (h + r)$$

$$= \frac{2 \times 22 \times 7}{7} \left(\frac{21}{2} + 7 \right) = \frac{44 \times 35}{2} \text{ cm}^2$$

$$\text{T.S.A of cylinder} = 770 \text{ cm}^2$$

12. Given that a heap of rice is in the form of a cone.

Height of a heap of rice (h) = 3.5 m

and diameter of a heap of rice = 24 m

\therefore Radius of a heap of rice (r) = 12 m

$$\left[\because \text{Radius} = \frac{1}{2} \times \text{diameter} \right]$$

$$\text{So, volume of rice} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 3.5 = 528 \text{ m}^3$$

Now, canvas cloth required to just cover heap of rice

= Surface area of a heap of rice = $\pi r l$

$$= \frac{22}{7} \times r \times \sqrt{r^2 + h^2} = \frac{22}{7} \times 12 \times \sqrt{(12)^2 + (3.5)^2}$$

$$= \frac{12 \times 22}{7} \times \sqrt{144 + 12.25} = \frac{12 \times 22}{7} \times \sqrt{156.25}$$

$$= \frac{12 \times 22}{7} \times 12.5 = 471.42 \text{ m}^2$$

Hence, 471.42 m² canvas cloth is required to just cover the heap.

13. Let height of cylinder = h cm and

radius of cylinder = r cm

Given, $r + h = 37$ cm

Total surface area of cylinder = $2\pi rh + 2\pi r^2$

$$\Rightarrow 2\pi r(r + h) = 1628 \Rightarrow 2\pi r(37) = 1628$$

$$\Rightarrow r = \frac{1628 \times 7}{2 \times 22 \times 37} = 7$$

$$\therefore r + h = 37 \Rightarrow 7 + h = 37 \Rightarrow h = 30$$

Hence, volume of cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times 7 \times 7 \times 30 = 4620 \text{ cm}^3$$

14. Radius (r) of cone = 3 cm

Curved surface area of cone, $\pi rl = 47.1 \text{ cm}^2$

$$= 3.14 \times (3) \times l = 47.1$$

$$\Rightarrow l = \frac{47.1}{3 \times 3.14} = 5 \text{ cm}$$

$$\text{Now, } l^2 = h^2 + r^2 \Rightarrow h^2 = 25 - 9 = 16 \Rightarrow h = 4 \text{ cm}$$

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

$$= \frac{1}{3} \times 3.14 \times 3 \times 3 \times 4 = 37.68 \text{ cm}^3$$

15. Radius (r) of conical tent = 7 m

Height (h) of conical tent = 24 m

$$\therefore \text{Slant height (l)} = \sqrt{(24)^2 + (7)^2} = \sqrt{625} = 25 \text{ m}$$

Curved surface area of tent = πrl

$$= \frac{22}{7} \times 7 \times 25 = 550 \text{ m}^2$$

Width of cloth used = 5m

Let length of cloth used is x m.

\therefore Area of cloth = curved surface area of tent

$$\Rightarrow 5x = 550$$

$$\Rightarrow x = 110$$

Hence, cost of cloth used at rate of *25 per metre

$$= (110 \times 25) = 2750$$

16.

Ques 14

(a) CSA of one cap = square cm paper required for one cap

$$2\pi r = 44$$

$$2 \times \frac{22}{7} \times r = 44$$

$$r = \frac{44 \times 7}{2 \times 22} = 7 \text{ cm}$$

$$l^2 = h^2 + r^2$$

$$l^2 = 24^2 + 7^2$$

$$l^2 = 576 + 49$$

$$l^2 = 625$$

$$l = 25 \text{ cm}$$

CSA of one cap = $\pi r l$

$$= \frac{22}{7} \times 7 \times 25$$

$$= 550 \text{ cm}^2$$

CSA of four caps i.e. square cm paper required for four caps = 4×550

$$= 2200 \text{ cm}^2$$

(b) Volume of cake = $\pi r^2 h$

$$= \frac{22}{7} \times 12 \times 12 \times 14$$

$$= 6336 \text{ cm}^3$$

$650 \text{ cm}^3 = 100 \text{ g or } 0.1 \text{ kg}$

$$\frac{6336 \text{ cm}^3}{650} = \frac{0.1 \text{ kg} \times 6336}{100} = \frac{6336}{6500} = \frac{95.9}{100} = 0.95 \text{ kg}$$

So they should order a 1 kg cake.

[Topper's Answer, 2022]

17.

Ques 6

(b) length of cuboid = 18 cm

Breadth of cuboid = 6 cm

Height of cuboid = 6 cm

TSA of the cuboid = $2(lb + bh + hl)$

$$= 2(18 \times 6 + 6 \times 6 + 6 \times 18)$$

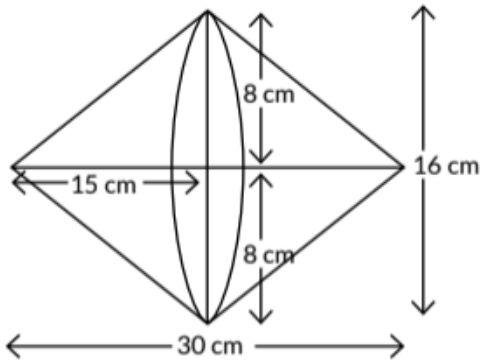
$$= 2(108 + 36 + 108)$$

$$= 2(252)$$

$$= 504 \text{ cm}^2$$

[Topper's Answer, 2022]

18. If two cones with same base and height are joined together along their bases, then the shape so formed looks as the figure given below:



Given that diameter of cone (d) = 16 cm

so radius of cone (r) = 8 cm

and height of cone (h) = 15 cm

∴ Surface area of the shape so formed = 2 x curved surface area of the shape so formed [Both cones are identical]

$$= 2 \times \pi r l = 2 \times \pi \times r \times \sqrt{h^2 + r^2} = 2 \times \frac{22}{7} \times 8 \times \sqrt{8^2 + 15^2}$$

$$= 2 \times \frac{22}{7} \times 8 \times 17 \text{ cm}^2$$

$$\text{Surface area} = \frac{5984}{7} \text{ cm}^2 = 855 \text{ cm}^2 \text{ (approx.)}$$

19. Radius of the cylinder (r) = 3.5 cm

Height of the cylinder (h) = 10 cm

∴ Curved surface area of cylinder = $2\pi rh$

$$= 2 \times \frac{22}{7} \times \frac{35}{10} \times 10 \text{ cm}^2 = 220 \text{ cm}^2$$

Curved surface area of a hemisphere = $2\pi r^2$

∴ Curved surface area of both hemispheres

$$= 2 \times 2\pi r^2 = 4\pi r^2 = 4 \times \frac{22}{7} \times \frac{35}{10} \times \frac{35}{10} \text{ cm}^2$$

$$= 154 \text{ cm}^2$$

Total surface area of the remaining solid

$$= (220 + 154) \text{ cm}^2 = 374 \text{ cm}^2.$$

20. Total surface area of the block

= Surface area of cube + curved surface area of hemisphere
- area of base of hemisphere

$$\text{Surface area of cube} = 6a^2 = 6 \times 6^2 = 216 \text{ cm}^2$$

Curved surface area of hemisphere - area of base of hemisphere = $2\pi r^2 - \pi r^2 = \pi r^2$

$$= \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} = 9.625 \text{ cm}^2$$

∴ Required total surface area of the block

$$= 216 + 9.625 = 225.625 \text{ cm}^2$$

21. Radius (r) of cone = radius (r) of hemisphere

$$= 3.5 \text{ cm}$$

Height (H) of toy

$$= 15.5 \text{ cm}$$

∴ Height (h) of cone

$$= 15.5 - 3.5 = 12 \text{ cm}$$

Hence, slant height (l)

$$\text{of cone} = \sqrt{h^2 + r^2}$$

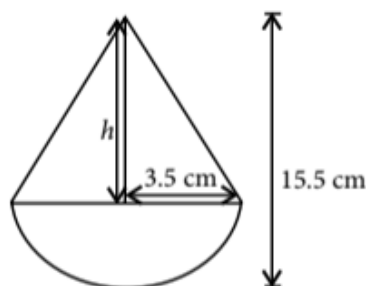
$$= \sqrt{(12)^2 + (3.5)^2}$$

$$= \sqrt{144 + 12.25} = 12.5 \text{ cm}$$

∴ Total surface area of toy = $\pi r l + 2\pi r^2$

$$= \frac{22}{7} \times 3.5(12.5) + 2 \times \frac{22}{7} (3.5)^2 = \frac{22 \times 3.5}{7} (12.5 + 7)$$

$$= \frac{1501.5}{7} = 214.5 \text{ cm}^2$$



22. Let r and h be radius and height of cylinder respectively and l be the slant height of cone.

Total curved surface area of tent = $2\pi r h + \pi r l$

$$= \frac{22}{7} \left[\left(2 \times \frac{3}{2} \times 2.1 \right) + \left(\frac{3}{2} \times 2.8 \right) \right] = \frac{22}{7} \times 10.5 = 33 \text{ m}^2$$

∴ Total cost of canvas needed to make the tent

$$= ₹(500 \times 33) = ₹16500$$

23. We have length of cuboid (l) = 15 cm

Breadth of cuboid (b) = 10 cm

Height of cuboid (h) = 5 cm = Height of cylinder

$$\text{Radius of cylinder } (r) = \frac{7}{2} \text{ cm}$$

Surface area of remaining block = Surface area of cuboidal block - 2(area of top of cylindrical part) + inner curved surface area of cylinder

$$= 2(lb + bh + hl) - 2(\pi r^2) + 2\pi rh$$

$$= 2(15 \times 10 + 10 \times 5 + 5 \times 15) - 2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} + 2 \times \frac{22}{7} \times \frac{7}{2} \times 5$$

$$= 2(150 + 50 + 75) - 77 + 110 = 583 \text{ cm}^2$$

24.

$$\text{Radius of cylindrical part, } r = \frac{4.2}{2} = 2.1 \text{ m}$$

= radius of conical part

Height of cylindrical part,

$$h = 4 \text{ m}$$

Height of conical part,

$$H = 2.8 \text{ m}$$

$$\therefore \text{Slant height, } l = \sqrt{H^2 + r^2}$$

$$= \sqrt{(2.8)^2 + (2.1)^2}$$

$$= \sqrt{7.84 + 4.41} = \sqrt{12.25} = 3.5 \text{ m}$$

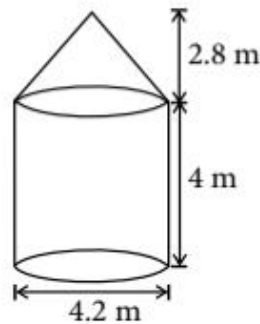
Area of canvas used = curved surface area of cylinder + curved surface area of cone

$$= 2\pi rh + \pi rl = \pi r(2h + l)$$

$$= \frac{22}{7} \times 2.1(2 \times 4 + 3.5) = \frac{22}{7} \times 2.1 \times 11.5 = 75.9 \text{ m}^2$$

$$\text{Cost of a tent} = ₹(100 \times 75.9) = ₹ 7590$$

$$\text{Cost of 100 tents} = ₹(7590 \times 100) = ₹ 759000$$



The amount paid by associations

$$= ₹ \left(\frac{50}{100} \times 759000 \right) = ₹ 379500$$

The values shown by these associations are helping, concern with society.

25. The largest diameter of hemisphere

= Side of the cube = 10 cm

$$\therefore \text{Radius of hemisphere} = \frac{10}{2} = 5 \text{ cm}$$

Total surface area of solid = Total surface area of cube
- Area of base of hemisphere + curved surface area of hemisphere

$$= 6a^2 - \pi r^2 + 2\pi r^2 = 6a^2 + \pi r^2$$

$$= 6 \times 10 \times 10 + 3.14 \times 5 \times 5 = 600 + 78.5 = 678.5 \text{ cm}^2$$

\therefore Cost of painting the solid

$$= ₹ \left(\frac{5}{100} \times 678.5 \right) = ₹ 33.93$$

26. Radius of the cylinder (r) = 3.5 cm

Height of the cylinder (h) = 10 cm

.. Curved surface area = $2\pi rh$

$$= \left(2 \times \frac{22}{7} \times \frac{35}{10} \times 10 \right) \text{ cm}^2 = 220 \text{ cm}^2$$

Curved surface area of a hemisphere = $2\pi r^2$

\therefore Curved surface area of both hemispheres

$$= 2 \times 2\pi r^2 = 4\pi r^2 = \left(4 \times \frac{22}{7} \times \frac{35}{10} \times \frac{35}{10} \right) \text{ cm}^2 = 154 \text{ cm}^2$$

Total surface area of the Article

$$= (220 + 154) \text{ cm}^2 = 374 \text{ cm}^2.$$

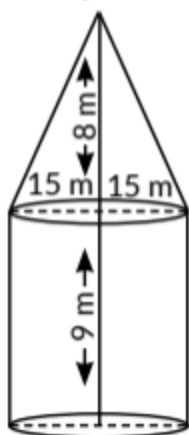


27. (i) Given, height of the cylindrical part (h) = 9 m

Height of conical part (h') = 8 m

Diameter of the cylindrical part

= Diameter of the conical part = d = 30 m



$$\therefore \text{Radius, } r = \frac{d}{2} = \frac{30}{2} = 15 \text{ m}$$

Now, slant height of the conical part (l)

$$= \sqrt{r^2 + h^2}$$

$$= \sqrt{(15)^2 + (8)^2} = \sqrt{225 + 64} = \sqrt{289} = 17 \text{ m}$$

Area of the canvas used in making the tent

$$= 2\pi rh + \pi rl = \pi r(2h + l)$$

$$= \frac{22}{7} \times 15 \times (2 \times 9 + 17) = \frac{22}{7} \times 15 \times 35 = 1650 \text{ sq. m}$$

Hence, 1650 sq. m canvas is used in making the tent.

(ii) Since, 30 sq. m canvas was wasted during stitching.

$$\therefore \text{Total canvas required} = (1650 + 30) \text{ sq. m} \\ = 1680 \text{ sq. m}$$

So, cost of the canvas at the rate of ₹ 200 per sq. m

$$= ₹ (200 \times 1680) = ₹ 3,36,000$$

28.

Height (h) of the conical part = Height (h) of the cylindrical part = 2.8 cm

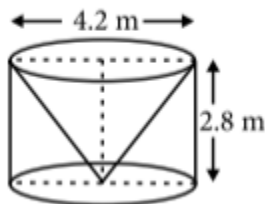
Diameter of the cylindrical part

= Diameter of the conical part = 4.2 cm

\therefore Radius (r) of the cylindrical part

= Radius (r) of the conical part = 2.1 cm

Slant height (l) of the conical part



Total surface area of the remaining solid = Curved surface area of the cylindrical part + Curved surface area of the conical part + Area of the base of the cylinder

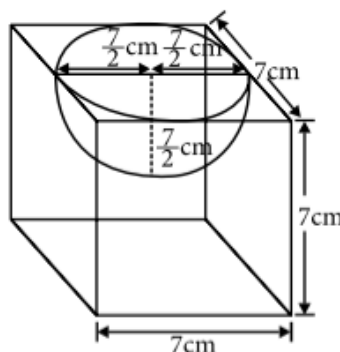
$$\begin{aligned}
 &= 2\pi rh + \pi rl + \pi r^2 \\
 &= 2 \times \frac{22}{7} \times 2.1 \times 2.8 + \frac{22}{7} \times 2.1 \times 3.5 + \frac{22}{7} \times 2.1 \times 2.1 \\
 &= 36.96 + 23.1 + 13.86 = 73.92 \text{ cm}^2
 \end{aligned}$$

29.

Diameter of hemisphere
= Edge of cube = 7 cm
Radius of hemisphere (r) = $\frac{7}{2}$ cm

Required surface area
= surface area of cube - area of top of hemisphere + curved surface area of hemisphere

$$\begin{aligned}
 &= 6a^2 - \pi r^2 + 2\pi r^2 = 6a^2 + \pi r^2 \\
 &= 6(7)^2 + \pi \left(\frac{7}{2}\right)^2 \\
 &= 6 \times 49 + \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \\
 &= 294 + 38.5 = 332.5 \text{ cm}^2
 \end{aligned}$$



30. Let r be the radius and h be the height of the cylindrical part and R be the radius of hemispherical part.

$$\therefore R = \frac{1}{2}h = r$$

Now, volume of air = $\frac{2}{3}\pi R^3 + \pi r^2 h$

$$\therefore \frac{1408}{21} = \frac{2}{3} \times \frac{22}{7} \times \left(\frac{1}{2}h\right)^3 + \frac{22}{7} \left(\frac{1}{2}h\right)^2 \times h$$

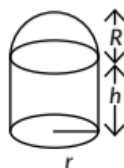
$$\Rightarrow \frac{1408}{21} = \frac{22}{7} \times \left(\frac{1}{2}\right)^2 \times h^3 \left(\frac{2}{3} \times \frac{1}{2} + 1\right)$$

$$\Rightarrow \frac{1408}{21} \times \frac{7 \times 4}{22} = \frac{4}{3}h^3$$

$$\Rightarrow h^3 = \frac{1408 \times 7 \times 4 \times 3}{21 \times 22 \times 4} = 64$$

$$\Rightarrow h = 4$$

Now, radius of hemispherical part $R = \frac{1}{2}h = 2$ m



∴ Total height of the room = R+h=2+4=6m

31. Radius of cone, r = 3 cm

Height of cone, h = 12 cm

Let x be the volume of unfilled part of cone.

$$\text{Now, volume of cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times 3.14 \times (3)^2 \times 12$$

Volume of filled part of cone

= Volume of cone - Volume of unfilled part of cone

$$= \frac{1}{3} \times 3.14 \times (3)^2 \times 12 - \frac{1}{6} \times \frac{1}{3} \times 3.14 \times (3)^2 \times 12$$

$$= \frac{1}{3} \times 3.14 \times (3)^2 \times 12 \left(1 - \frac{1}{6}\right)$$

$$= \frac{5}{6} \times \frac{1}{3} \times 3.14 \times (3)^2 \times 12 = 94.2 \text{ cm}^3$$

Now, volume of ice-cream

= volume of filled part of cone + volume of hemisphere

$$= 94.2 + \frac{2}{3} \times 3.14 \times (3)^3 = 150.72 \text{ cm}^3$$

32.

Radius of cylindrical part (r)

$$= \text{Radius of each spherical part}(r) = \frac{7}{2} \text{ cm}$$

$$\text{Height of cylindrical part (h)} = 20 - \frac{7}{2} - \frac{7}{2} = 13 \text{ cm}$$

Now, Volume of the solid = Volume of cylindrical part +
Volume of two hemispherical ends

$$\text{Volume of the solid} = \pi r^2 h + 2 \left(\frac{2}{3} \pi r^3 \right)$$

$$= \pi r^2 \left[h + \frac{4}{3} r \right] = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \left[13 + \frac{4}{3} \times \frac{7}{2} \right]$$

$$= \frac{77}{2} \left[13 + \frac{14}{3} \right] = \frac{77}{2} \times \frac{53}{3} = \frac{4081}{6} \text{ cm}^3$$

$$\text{Volume of the solid} = 680.17 \text{ cm}^3.$$

33.

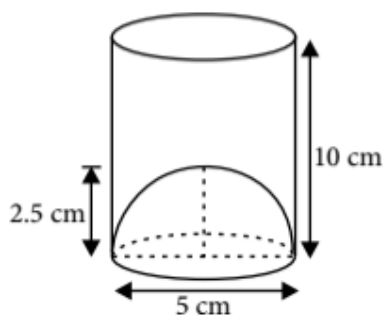
$$\text{Base radius} = \frac{5}{2} = 2.5 \text{ cm}$$

Apparent capacity of glass = Volume of cylindrical portion

$$\begin{aligned} &= \pi r^2 h \\ &= 3.14 \times (2.5)^2 \times 10 \\ &= 196.25 \text{ cm}^3 \end{aligned}$$

Actual capacity of the glass = Volume of cylinder - Volume of hemisphere

$$\begin{aligned} &= \pi r^2 h - \frac{2}{3} \pi r^3 = 196.25 - \frac{2}{3} \times 3.14 \times (2.5)^3 \\ &= 196.25 - 32.71 = 163.54 \text{ cm}^3 \end{aligned}$$



34.

$$\text{Volume of cylindrical tub} = \pi r^2 h$$

$$= \pi \left(\frac{12}{2} \right)^2 \times 15 = 540\pi \text{ cm}^3$$

Quantity of ice-cream, given to one child

$$= \frac{540\pi}{10} = 54\pi \text{ cm}^3$$

... (i)

Let r be the radius of conical base and h be the height of conical portion.

$$\therefore h = 2(2r) = 4r$$

Capacity of one ice-cream cone

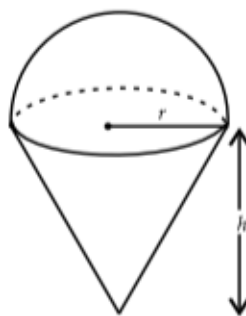
$$\begin{aligned} &= \frac{1}{3} \pi r^2 h + \frac{2}{3} \pi r^3 = \frac{1}{3} \pi r^2 (4r) + \frac{2}{3} \pi r^3 \\ &= 2\pi r^3 \end{aligned}$$

... (ii)

From (i) and (ii), $2\pi r^3 = 54\pi$

$$\Rightarrow r^3 = 27 \Rightarrow r = 3 \text{ cm}$$

\therefore Diameter of conical part of ice-cream cone
 $= 2r = 6 \text{ cm}$



35.

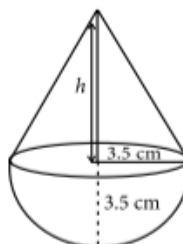
$$\text{Volume of solid wooden toy} = 166\frac{5}{6} \text{ cm}^3$$

$$\Rightarrow \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h = \frac{1001}{6}$$

(Where r is radius of cone and hemisphere)

$$\Rightarrow \pi r^2 \left(\frac{2r}{3} + \frac{h}{3} \right) = \frac{1001}{6}$$

$$\Rightarrow \frac{22}{7} \times 3.5 \times 3.5 \left(\frac{2 \times 3.5 + h}{3} \right) = \frac{1001}{6}$$



$$\Rightarrow 38.5 \left(\frac{7+h}{3} \right) = \frac{1001}{6} \Rightarrow 7+h = \frac{1001 \times 3}{6 \times 38.5} = 13$$

$$\Rightarrow h = 6 \text{ cm}$$

\therefore Total height of the toy

$$= 6 + 3.5 = 9.5 \text{ cm}$$

Curved surface area of hemispherical part = $2\pi r^2$

$$= 2 \times \frac{22}{7} \times 3.5 \times 3.5 = 77 \text{ cm}^2$$

$$\therefore \text{Cost of painting} = ₹(10 \times 77) = ₹ 770$$

36.

Radius of cylinder, $r_1 = 3 \text{ cm}$

Height of cylinder, $h_1 = 5 \text{ cm}$

\therefore Volume of cylinder

$$= \pi r_1^2 h_1 = \pi (3)^2 \times 5$$

$$= 45\pi \text{ cm}^3$$

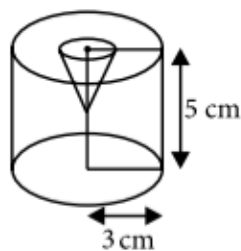
Radius of cone, $r_2 = \frac{3}{2} \text{ cm}$;

Height of cone, $h_2 = \frac{8}{9} \text{ cm}$

Volume of cone = Volume of metal taken out

$$= \frac{1}{3}\pi r_2^2 h_2$$

$$= \frac{1}{3}\pi \left(\frac{3}{2} \right)^2 \times \frac{8}{9} = \frac{2}{3}\pi \text{ cm}^3 \quad \dots(i)$$



Volume of metal left in the cylinder = Volume of cylinder
- Volume of cone

$$= 45\pi - \frac{2}{3}\pi = \frac{133\pi}{3}$$

$$\therefore \frac{\text{Volume of metal left in cylinder}}{\text{Volume of metal taken out}} = \frac{\frac{133\pi}{3}}{\frac{2}{3}\pi}$$

$$= \frac{133}{2} = 133:2$$

37. Here, $r_{\text{cone}} = 30$ cm, $h_{\text{cone}} = 60$ cm,
 $R_{\text{cylinder}} = 60$ cm and $H_{\text{cylinder}} = 180$ cm

Volume of water left

= Volume of cylinder - Volume of cone

$$= \pi R^2 H - \frac{1}{3} \pi r^2 h$$

$$= \pi (60)^2 \times 180 - \frac{1}{3} \pi (30)^2 \times 60$$

$$= \pi \times 60 \left[60 \times 180 - \frac{1}{3} \times 30 \times 30 \right]$$

$$= \pi \times 60 [10800 - 300] = 60\pi [10500]$$

$$= 630000 \times \frac{22}{7} = 1980000 \text{ cm}^3 = 1.98 \text{ m}^3$$

38.

Side of cube = Diameter of sphere = 7 cm

$$\therefore \text{Volume of cube} = a^3 = (7)^3$$

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3$$

$$= \frac{11}{21} (7)^3$$

Hence, volume of the wood left

= Volume of cube - Volume of sphere

$$= (7)^3 \left[1 - \frac{11}{21} \right] = (7)^3 \times \frac{10}{21} = 163.33 \text{ cm}^3$$

39. Given diameter of circular pipe = 8 cm

So, radius of circular pipe = 4 cm

Length of flow of water in one sec. = 80 cm

length of flow of water in one hour = $80 \times 60 \times 60$ cm.

Volume of cylindrical pipe in one hour = $\Delta r^2 h$

$$\begin{aligned} &= \frac{22}{7} \times 4 \times 4 \times 288000 \text{ cm}^3 \\ &= \frac{101376000}{7} \text{ cm}^3 = \frac{10137}{7} \text{ litre} \quad [\because 1000 \text{ cm}^3 = 1 \text{ litre}] \\ &= 14482.28 \text{ litre (approx.)} \\ &14482.28 \text{ litres of water being pumped out through this pipe in 1 hr.} \end{aligned}$$

40.

Diameter of cylindrical well (d) = 3 m

$$\Rightarrow \text{Radius of cylindrical well} = \frac{3}{2} \text{ m} = 1.5 \text{ m}$$

Depth of the well (h) = 14 m

$$\therefore \text{Volume} = \pi r^2 h = \frac{22}{7} \times \left(\frac{15}{10}\right)^2 \times 14 \text{ m}^3$$

$$\text{Volume} = \frac{22 \times 15 \times 15 \times 14}{7 \times 10 \times 10} \text{ m}^3 = 99 \text{ m}^3$$

Let the height of the platform = H metre

Internal radius of platform (r) = 1.5 m

$$\therefore \text{Volume of the platform } R = (4 + 1.5) \text{ m} = 5.5 \text{ m}$$

$$= \pi R^2 H - \pi r^2 H$$

$$= \pi H (R^2 - r^2) = \pi H (R - r) (R + r)$$

$$= \frac{22}{7} \times H (5.5 + 1.5) (5.5 - 1.5)$$

$$= \frac{22}{7} \times H \times 7 \times 4 \text{ m}^3$$

Since volume of platform = volume of cylindrical well

$$\therefore \frac{22}{7} \times H \times 7 \times 4 = 99 \Rightarrow H = 99 \times \frac{7}{22} \times \frac{1}{7} \times \frac{1}{4}$$

$$= \frac{9}{8} = 1.125$$

Thus the required height of the platform = 1.125 m

41. Given diameter of conical part

= Diameter of hemispherical part = 4 cm

∴ Radius of conical part (r)

$$= \text{Radius of hemispherical part (r)} = \frac{4}{2} = 2 \text{ cm}$$

Height of conical part (h) = 2 cm

∴ Volume of toy = Volume of hemisphere + volume of cone

$$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h = \pi r^2 \left[\frac{2}{3}r + \frac{1}{3}h \right] = 3.14 \times 2 \times 2 \left[\frac{2}{3} \times 2 + \frac{1}{3} \times 2 \right]$$

$$= 3.14 \times 4 [1.33 + 0.66] = 3.14 \times 4 \times 1.99 \text{ cm}^3$$

$$\text{Volume of the toy} = 24.99 \text{ cm}^3$$

42.

Radius of the cone = Radius of the hemisphere

$$= r = 7 \text{ cm}$$

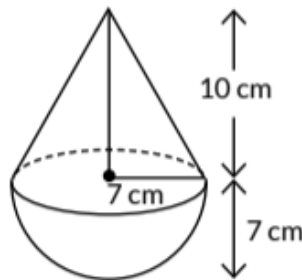
Height of the cone,

$$h = 10 \text{ cm}$$

Now, volume of the toy = volume of hemisphere + volume of cone

$$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h = \frac{\pi r^2}{3}(2r + h)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 (2 \times 7 + 10) = \frac{22 \times 7 \times 24}{3} = 1232 \text{ cm}^3$$



Curved surface area of the toy = Curved surface area of cone + Curved surface area of hemisphere = $\pi r l + 2\pi r^2$

$$= \pi r \sqrt{h^2 + r^2} + 2\pi r^2 = \pi r (\sqrt{h^2 + r^2} + 2r)$$

$$= \frac{22}{7} \times 7 (\sqrt{10^2 + 7^2} + 14) = 22(\sqrt{149} + 14)$$

$$= 22(12.2 + 14) = 22 \times 26.2 = 576.4 \text{ cm}^2$$

CBSE Sample Questions

1.



$$\text{Curved surface area of cone} = \pi r l = 12320 \text{ cm}^2 \quad (1/2)$$

$$\Rightarrow \frac{22}{7} \times 56 \times l = 12320$$

$$\Rightarrow l = 70 \text{ cm} \quad (1)$$

$$\text{Since, height } h = \sqrt{l^2 - r^2}$$

$$\Rightarrow h = \sqrt{70^2 - 56^2} = 42 \text{ cm} \quad (1/2)$$

2.

(c): Assume length l , breadth b and height h of cuboid.

$$\text{Given, } l + b + h = 6\sqrt{3} \text{ cm} \quad \dots(i)$$

$$\text{Also, } \sqrt{l^2 + b^2 + h^2} = 2\sqrt{3} \text{ cm} \quad \dots(ii)$$

$$\text{Squaring (i), we get } (l + b + h)^2 = 108$$

$$\Rightarrow l^2 + b^2 + h^2 + 2(lb + bh + lh) = 108$$

$$\Rightarrow 2(lb + bh + lh) = 96 \quad [\text{From (ii)}]$$

Area of cuboid is,

$$2(lb + bh + lh) = 96 \text{ cm}^2 \quad (1)$$

3. Radius of the base of cylinder (r) = 2.8 m = Radius of the base of the cone (r)

Height of the cylinder (h) = 3.5 m

Height of the cone (H) = 2.1 m.

$$\text{Slant height of conical part } (l) = \sqrt{r^2 + H^2} \quad (1)$$

$$= \sqrt{(2.8)^2 + (2.1)^2} = \sqrt{7.84 + 4.41}$$

$$= \sqrt{12.25} = 3.5 \text{ m}$$

$$\text{Area of canvas used to make tent} \quad (2)$$

$$= \text{CSA of cylinder} + \text{CSA of a cone}$$

$$= 2 \times \pi \times 2.8 \times 3.5 + \pi \times 2.8 \times 3.5$$

$$= 61.6 + 30.8 = 92.4 \text{ m}^2$$

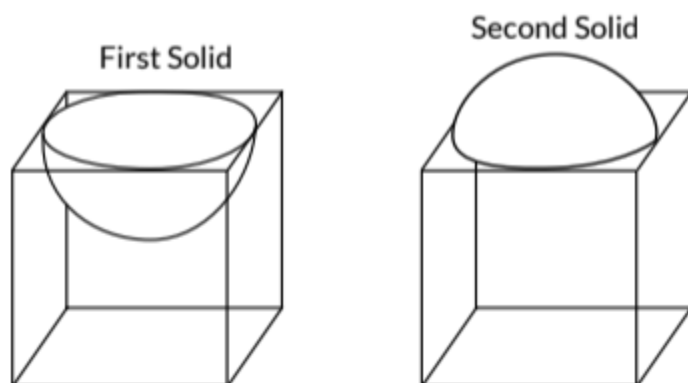
$$\text{Cost of 1500 tents at ₹ 120 per sq. m} \quad (1)$$

$$= ₹ 1500 \times 120 \times 92.4 = ₹ 16,632,000$$

$$\text{Share of each school to set up the tents} \quad (1)$$

$$= ₹ 16632000 / 50 = ₹ 332,640$$

4.



Let side of cube is $a = 7$ cm

(i) SA for first new solid (S_1): (1)

$$6a^2 + 2\pi\left(\frac{a}{2}\right)^2 - \pi\left(\frac{a}{2}\right)^2$$

$$6 \times 7 \times 7 + 2\pi \times 3.5^2 - \pi \times 3.5^2 = 294 + 77 - 38.5 \\ = 332.5 \text{ cm}^2$$

SA for second new solid (S_2): (1)

$$6 \times 7 \times 7 + 2\pi \times 3.5^2 - \pi \times 3.5^2 = 294 + 77 - 38.5 \\ = 332.5 \text{ cm}^2$$

So, $S_1 : S_2 = 1 : 1$ So, (1/2)

(ii) Volume for first new solid (V_1) = $7 \times 7 \times 7 - \frac{2}{3}\pi \times 3.5^3$ (1)

$$= 343 - \frac{539}{6} = \frac{1519}{6} \text{ cm}^3 \quad (1/4)$$

Volume for second new solid (V_2) = $7 \times 7 \times 7 + \frac{2}{3}\pi \times 3.5^3$ (1)

$$= 343 + \frac{539}{6} = \frac{2597}{6} \text{ cm}^3 \quad (1/4)$$
