Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085

SUBJECT:- MATHEMATICS

CLASS-IX

Week : 11 January 2021 to 16 January 2021

Number of blocks: 3

CHAPTER-13 : SURFACE AREAS AND VOLUMES (part-1)

Sub-Topics:

- Solids
- Surface area of cuboid
- Surface area of cube

Link for the chapter: https://ncert.nic.in/textbook.php?iemh1=13-15

Learning Outcomes:

Each student will be able to:

- define three dimensional objects
- list different solid objects
- identify cuboid and cube
- find surface area of cube and cuboid
- apply the knowledge gained in real life

Teaching Aids Used:

Presentation of E-lesson, YouTube videos by screen sharing, white board and marker using laptop/mobile

GUIDELINES:

Dear students,

Kindly read the content given below and view the links shared for better understanding.

Solve the given questions in math notebook.

DAY-1

LESSON DEVELOPMENT

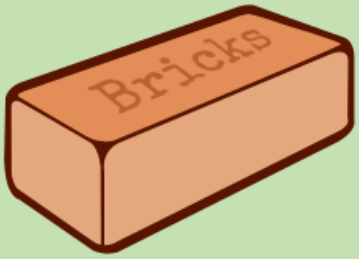
What are SOLIDS?

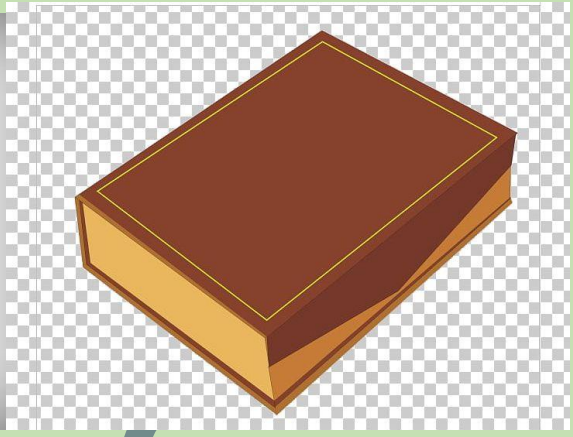
A solid occupies a particular amount of space. It has a definite shape and size. The three dimensions of a solid are its length, width and height.

Some examples of solids, cuboid , cube , cylinder , cone , sphere , pyramid , etc.

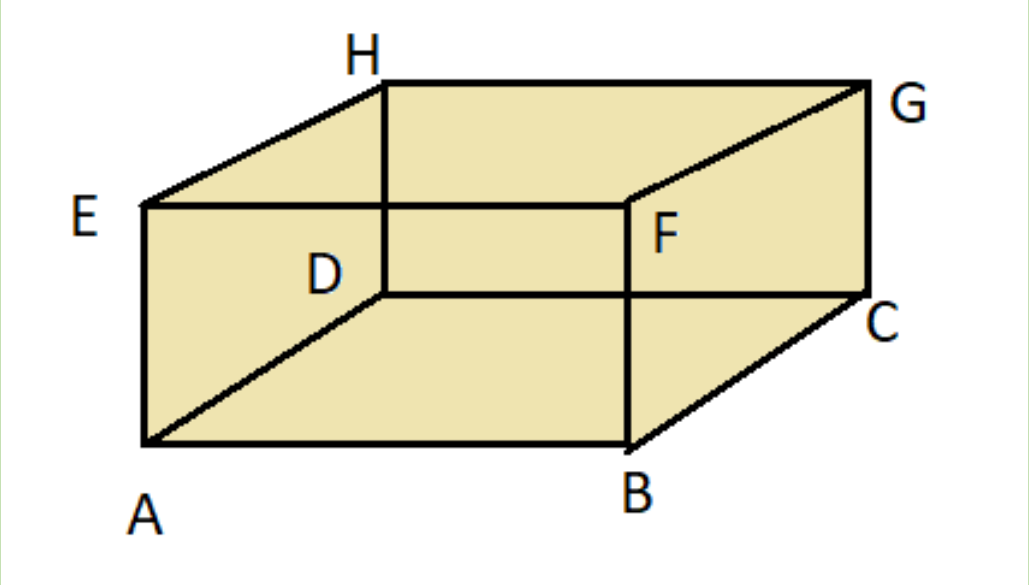
CUBOID

A solid bounded by six rectangular surfaces is called cuboid. We have seen a match box , a brick , a book ,etc. which are some examples of cuboid





PROPERTIES OF A CUBOID



A cuboid has 6 rectangular faces

The two adjacent faces of a cuboid meet to form a line segment. It is called the edge of a cuboid. It has 12 edges

The three edges of a cuboid meet to form a point. It is called a vertex of the cuboid. There are 8 vertices in a cuboid.

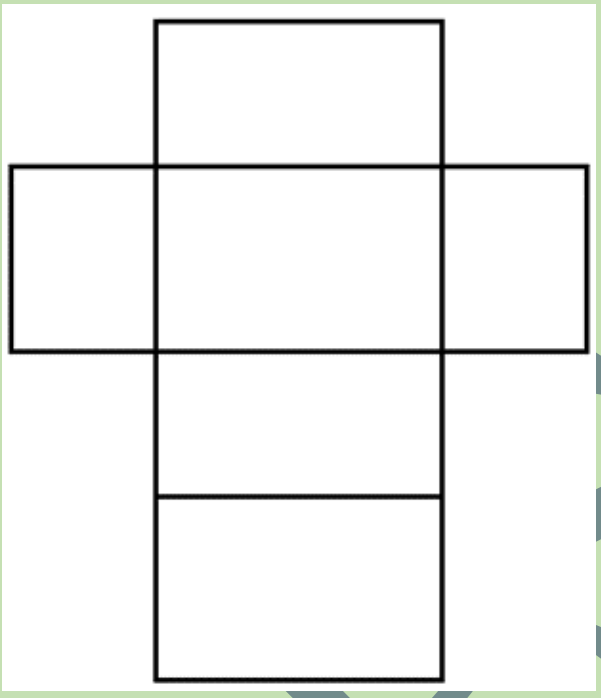
In a cuboid

a) Six faces are ABCD , EFGH , BCGF , ADHE , ABFE and DCGH

b) Twelve edges are AB , BC , CD , DA , EF , FG , GH , HE , AE , BF , CG , and DH

c) Eight vertices are A , B , C , D , E , F , G and H

NET OF CUBOID



SURFACE AREA OF CUBOID

Lateral Surface Area = $2 \times length \times height + 2 \times breadth \times height$

$$= 2h(l + b)$$

Total surface area=

$$2 \times length \times height + 2 \times breadth \times height + 2 \times length \times breadth$$

$$= 2lh + 2bh + 2lb$$

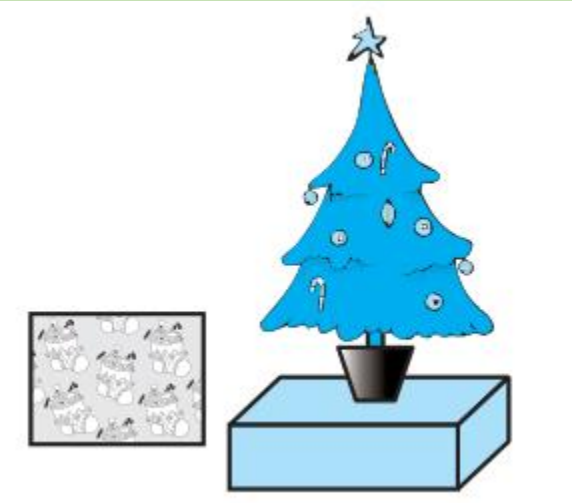
Link:

https://www.youtube.com/watch?v=7g69wLn0UjI

EXAMPLE:

Mary wants to decorate her Christmas tree. She wants to place the tree on a wooden box covered with colored paper with picture of Santa Claus on it. She must know the

exact quantity of paper to buy for this purpose. If the box has length, breadth and height as 80 cm, 40 cm and 20 cm respectively how many square sheets of paper of side 40 cm would she require?



SOLUTION:

Since Mary wants to paste the paper on the outer surface of the box; the quantity of paper required would be equal to the surface area of the box which is of the shape of a cuboid. The dimensions of the box are:

Length =80 cm, Breadth = 40 cm, Height = 20 cm.

The surface area of the box = $2(lb + bh + hl)$

$$= 2[(80 \times 40) + (40 \times 20) + (20 \times 80)]cm^2$$

$$= 2[3200 + 800 + 1600]cm^2$$

$$= 2 \times 5600\ cm^2$$

$$= 11200\ cm^2$$

The area of each sheet of the paper $= 40 \times 40\ cm^2$

$$= 1600\ cm^2$$

Therefore, number of sheets required $= \frac{surface\ area\ of\ the\ box}{area\ of\ one\ sheet\ of\ paper} = \frac{11200}{1600} = 7$

So, she would require 7 sheets.

ASSIGNMENT:

Complete the following questions from Exercise 13.1 of your NCERT book(page 213)

Q1, 2, 6, 8

Link:

https://www.youtube.com/watch?v=c83-Fbeg4cc&t=22s

https://www.youtube.com/watch?v=Jb-nsVB9Q6Q

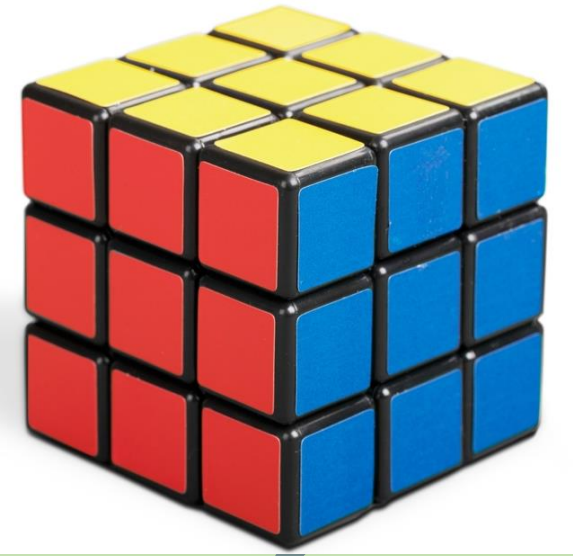
https://www.youtube.com/watch?v=zmLMjKRmNr4

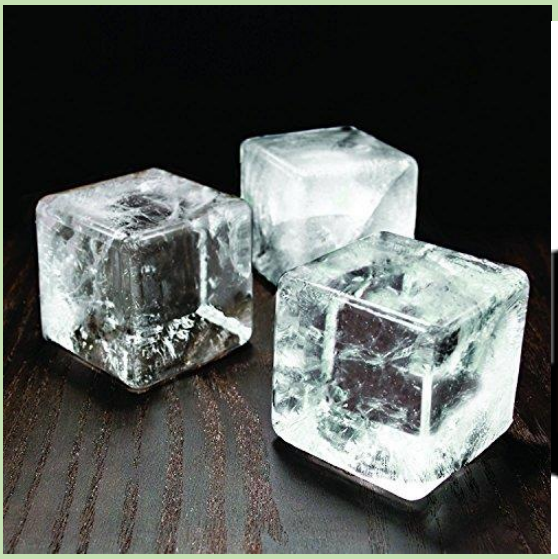
https://www.youtube.com/watch?v=W0QaYeb0Iis

DAY-2

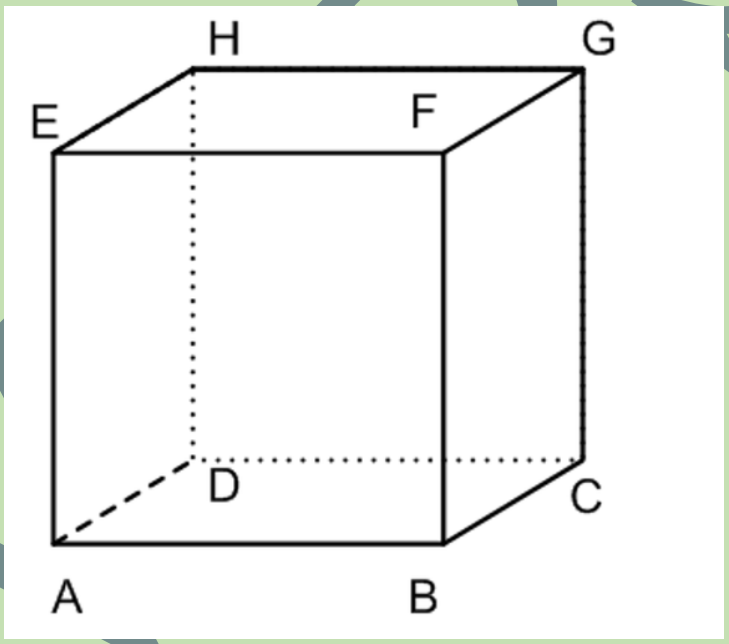
CUBE

- A solid bounded by six square faces in which the angles between two adjacent sides are right angles is called cube.
- Therefore, all the edges of a cube will be equal (Length = Breadth = Height)
- The cube is a special type of cuboid whose all sides are equal
- Examples : ice cube , dice , sugar cube , Rubik's cube , etc.





PROPERTIES OF CUBE

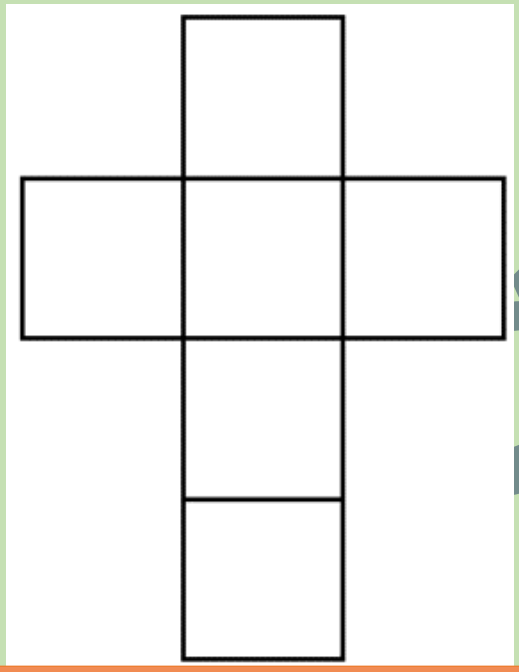


a) **6 faces** are ABCD , EFGH , BCGF , ADHE , ABFE and DCGH

b) **12 edges** are AB , BC , CD , DA , EF , FG , GH , HE , BF , CG , DH , and AE (All edges are equal)

c) **8 vertices** are A , B , C , D , E , F , G and H

NET OF CUBE



Lateral Surface Area = $4 \times side \times side = 4s^2$

Total surface area = $6 \times side \times side = 6s^2$

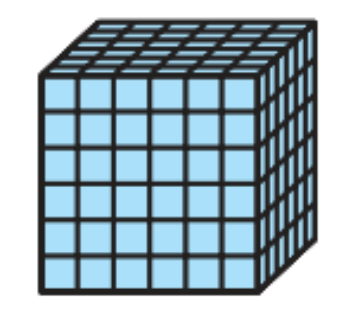
Link:

https://www.youtube.com/watch?v=VvfjrYiw41I

EXAMPLE:

Hameed has built a cubical water tank with lid for his house, with each outer edge 1.5 m long. He gets the outer surface of the tank excluding the base, covered with square tiles of side 25 cm (see Fig. 13.5). Find how much he would spend for the tiles, if the cost of the tiles is Rs 360 per dozen.

SOLUTION:



Since Hameed is getting the five outer faces of the tank covered with tiles, he would need to know the surface area of the tank, to decide on the number of tiles required.

Edge of the cubical tank $= 1.5\,m = 150\,cm\,(= a)$

So, surface area of the tank $= 5 \times 150 \times 150\,cm^2$

Area of each square tile = side × side $= 25 \times 25\,cm^2$

So, the number of tiles required $= \frac{surface\ area\ of\ the\ tank}{area\ of\ each\ tile}$

$$= \frac{5 \times 150 \times 150}{25 \times 25} = 180$$

Cost of 1 dozen tiles, i.e., cost of 12 tiles $= Rs\,360$

Therefore, cost of one tile $= Rs\,\frac{360}{12} = Rs\,30$

So, the cost of 180 tiles $= 180 \times Rs\,30 = Rs\,5400$

ASSIGNMENT:

Complete the following questions from Exercise 13.1 of your NCERT book(page 213)

Q3, 4, 5, 7

Link:

https://www.youtube.com/watch?v=VvfjrYiw41I

DAY-3

Exercise 13.1

Question 3:

The floor of a rectangular hall has a perimeter 250 m. If the cost of panting the four walls at the rate of Rs.10 per m^2 is Rs. 15000, find the height of the hall.

[*Hint*: Area of the four walls = Lateral surface area.]

Solution 3:

Let length, breadth, and height of the rectangular hall be l m, b m, and h m respectively.

Area of four walls = 2lh + 2bh = 2(l + b) h

Perimeter of the floor of hall = 2(l + b) = 250 m

∴ Area of four walls = 2(l + b) h = 250h m^2

Cost of painting per m^2 area = Rs. 10

Cost of painting 250h m^2 area = Rs. (250h × 10) = Rs. 2500h

However, it is given that the cost of paining the walls is Rs. 15000.

∴ 15000 = 2500h

h = 6

Therefore, the height of the hall is 6 m.

Question 4:

The paint in a certain container is sufficient to paint an area equal to 9.375 m^2. How many bricks of dimensions 22.5 cm × 10 cm × 7.5 cm can be painted out of this container?

Solution 4:

Total surface area of one brick = 2(lb + bh + lh)

= [2(22.5 ×10 + 10 × 7.5 + 22.5 × 7.5)] cm^2

= 2(225 + 75 + 168.75) cm^2

= (2 × 468.75) cm^2

= 937.5 cm^2

Let n bricks can be painted out by the paint of the container.

Area of n bricks = (n ×937.5) cm^2 = 937.5n cm^2

Area that can be painted by the paint of the container = 9.375 m^2 = 93750 cm^2

∴ 93750 = 937.5n

n = 100

Therefore, 100 bricks can be painted out by the paint of the container.

Question 7:

Shanti Sweets Stall was placing an order for making cardboard boxes for packing their sweets. Two sizes of boxes were required. The bigger of dimensions 25 cm × 20 cm × 5 cm and the smaller of dimensions 15 cm × 12 cm × 5 cm. For all the overlaps, 5% of the total surface area is required extra. If the cost of the cardboard is Rs. 4 for 1000 cm^2, find the cost of cardboard required for supplying 250 boxes of each kind.

Solution 7:

Length (l_1) of bigger box = 25 cm

Breadth (b_1) of bigger box = 20 cm

Height (h_1) of bigger box = 5 cm

Total surface area of bigger box = 2(lb + lh + bh)

= [2(25 × 20 + 25 × 5 + 20 × 5)] cm^2

= [2(500 + 125 + 100)] cm^2

= 1450 cm^2

Extra area required for overlapping = $\left(\frac{1450 \times 5}{100}\right)$ cm^2

= 72.5 cm^2

While considering all overlaps, total surface area of 1 bigger box
$= (1450 + 72.5)\ cm^2 = 1522.5\ cm^2$
Area of cardboard sheet required for 250 such bigger boxes
$= (1522.5 \times 250)\ cm^2 = 380625\ cm^2$
Similarly, total surface area of smaller box $= [2(15 \times 12 + 15 \times 5 + 12 \times 5]\ cm^2$
$= [2(180 + 75 + 60)]\ cm^2$
$= (2 \times 315)\ cm^2$
$= 630\ cm^2$

Therefore, extra area required for overlapping $= \left(\frac{630 \times 5}{100}\right)\ cm^2 = 31.5\ cm^2$

Total surface area of 1 smaller box while considering all overlaps
$= (630 + 31.5)\ cm^2 = 661.5\ cm^2$
Area of cardboard sheet required for 250 smaller boxes $= (250 \times 661.5)\ cm^2$
$= 165375\ cm^2$
Total cardboard sheet required $= (380625 + 165375)\ cm^2$
$= 546000\ cm^2$
Cost of 1000 cm2 cardboard sheet = Rs. 4
Cost of 546000 cm2 cardboard sheet = Rs. $\left(\frac{546000 \times 4}{1000}\right)$ = Rs. 2184

Therefore, the cost of cardboard sheet required for 250 such boxes of each kind will be Rs. 2184.

ASSIGNMENT:

Complete the questions from Exercise 13.1 of your NCERT book(page 213)

Complete the assignment and extra questions

Revise and practice all the questions

EXTRA QUESTIONS:

Q1)

The surface area of a cuboid is 1372 square centimetre. If its dimensions are in the ratio 4:2:1, then the length is:

(a) 7 cm
(b) 14 cm
(c) 21 cm
(d) 28cm

Q2)

Two cubes each of edge 12 cm are joined. The surface area of new cuboid is
(a) 140 cm^2
(b) 1440 cm^2
(c) 144 cm^2
(d) 72 cm^2

Q3)

The difference between the total surface area and lateral surface area of a cube of side 4cm is --------.

Q4)

The surface area of a cuboid is 1372 sq. cm. If its dimensions are in the ratio of 4 : 2 : 1, then find its length.

Q5)

.The areas of three adjacent faces of a cuboid are x, y and z. Find the total surface area of the cuboid.

Q6)

.If each side of a cube is increased by 10%. What is the percentage increase in surface area of the cube ?

Q7)

The length of a hall is 20 m and breadth is 16 m. The sum of areas of the floor and the top is equal to the sum of the areas of the four walls. Find the height of the wall.

Q8)

A class room is 7m long, 6.5 m wide and 4m high. It has one door of 3m × 1.4 m and three windows of measure 2 m × 1 m. The internal walls are to be color washed. The contractor charges Rs.5.52 per square meter. Find the cost of color washing.

Week : 18 January 2021 to 23 January 2021

Number of blocks: 3

CHAPTER-13 : SURFACE AREAS AND VOLUMES (part-2)

Sub-Topics:

- Surface area of right circular cylinder
- Surface area of right circular cone
- Surface area of sphere

Link for the chapter: https://ncert.nic.in/textbook.php?iemh1=13-15

Learning Outcomes:

Each student will be able to:

- list properties of cylinder, cone and sphere
- find surface area of right circular cylinder
- find surface area of right circular cone
- find surface area of sphere
- apply the knowledge gained in real life

Teaching Aids Used:

Presentation of E-lesson, YouTube videos by screen sharing, white board and marker using laptop/mobile

GUIDELINES:

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Solve the given questions in math notebook.

DAY-1

LESSON DEVELOPMENT

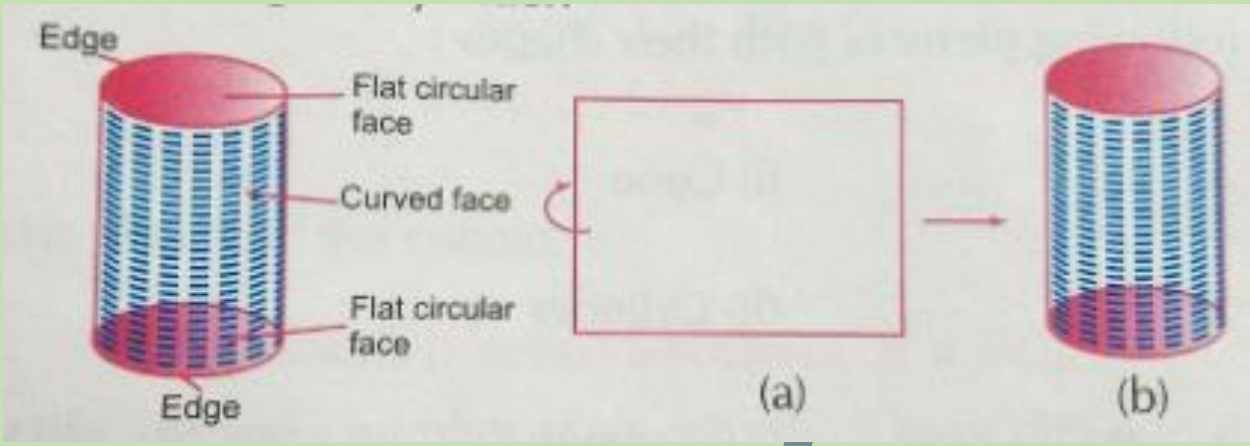
CYLINDER

A solid consisting of two plane congruent circular faces and one curved face is called a cylinder. It is also called circular prism

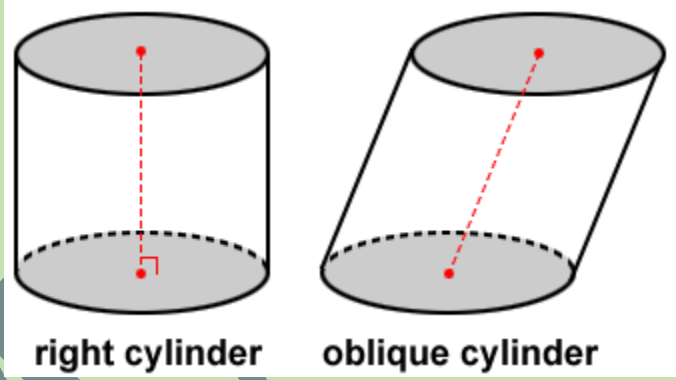
Thus, a cylinder has a curved face and two flat surfaces which are circular

PROPERTIES OF A CYLINDER

- A cylinder does not have any vertex.
- There are only two curved/circular edges.
- The solids, such as pitch roller, gas cylinder come under the category of a cylinder.
- If we roll a rectangular paper we can get a cylinder



TYPES OF CYLINDER

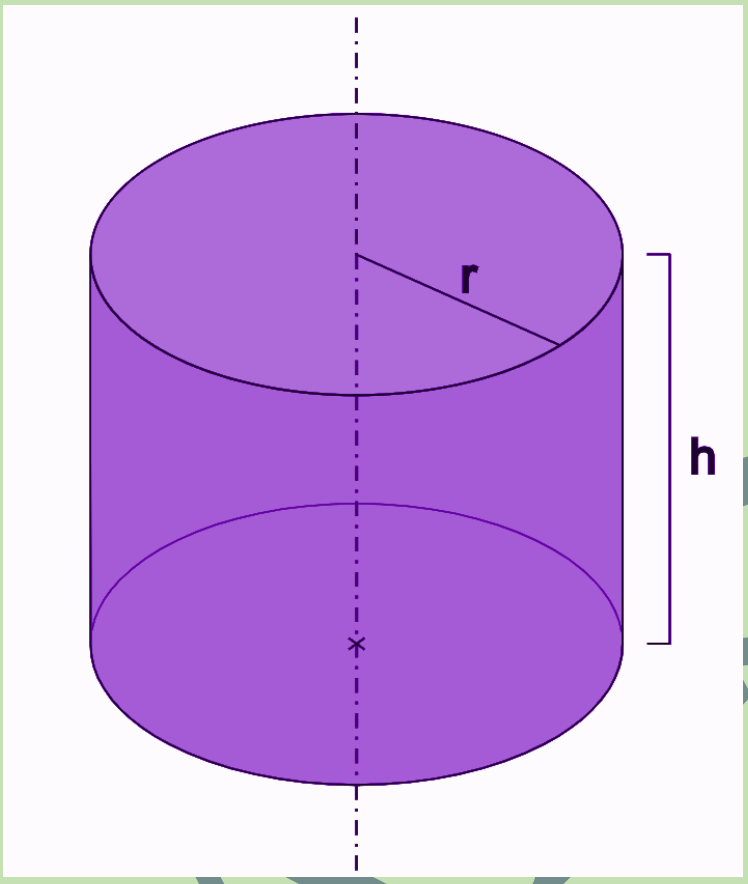


RIGHT CIRCULAR CYLINDER

A right circular cylinder has two plane ends.

Each plane end is circular in shape and the two plane ends are parallel

The line segment joining the centres of two bases is called the axis of cylinder



Curved Surface Area of right circular cylinder = $2\pi rh$

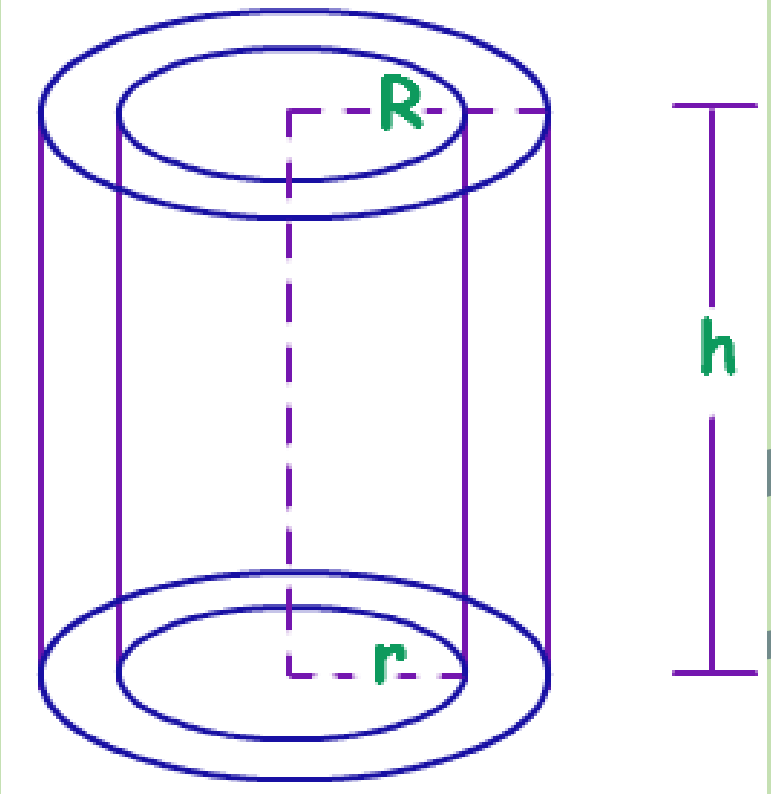
Total Surface area = $\pi r^2 + \pi r^2 + 2\pi rh$

$$= 2\pi r^2 + 2\pi rh = 2\pi r(r + h)$$

Link:

https://www.youtube.com/watch?v=gK9OgZ6eLx0

HOLLOW RIGHT CIRCULAR CYLINDER



Surface area of each base = $\pi(R^2 - r^2)$

Curved or Lateral Surface area $= 2\pi Rh + 2\pi rh$

$= 2\pi h(R + r)$

Total Surface area $= 2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$

$= 2\pi(R + r)(h + R - r)$

EXAMPLE:

Savitri had to make a model of a cylindrical kaleidoscope for her science project. She wanted to use chart paper to make the curved surface of the kaleidoscope. What would be the area of chart paper required by her, if she wanted to make a kaleidoscope of length 25 cm with a 3.5 cm radius? You may take $\pi = \frac{22}{7}$

SOLUTION:

Radius of the base of the cylindrical kaleidoscope (r) = 3.5 cm.

Height (length) of kaleidoscope (h) = 25 cm.

Area of chart paper required = curved surface area of the kaleidoscope

$$= 2\pi rh = 2 \times \frac{22}{7} \times 3.5 \times 25 = 550\ cm^2$$

Exercise 13.2

Question 2:

It is required to make a closed cylindrical tank of height 1 m and base diameter 140 cm from a metal sheet. How many square meters of the sheet are required for the same? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 2:

Height (h) of cylindrical tank = 1 m

Base radius (r) of cylindrical tank = $\frac{140}{2}$ cm = 70 cm = 0.7 m

Area of sheet required = Total surface area of tank = $2\pi r(r + h)$

$= \left(2 \times \frac{22}{7} \times 0.7(0.7 + 1)\right)$ m^2

$= (4.4 \times 1.7)$ m^2

$= 7.48$ m^2

Therefore, it will require 7.48 m^2 area of sheet.

Question 4:

The diameter of a roller is 84 cm and its length is 120 cm. It takes 500 complete revolutions to move once over to level a playground. Find the area of the playground in m^2? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 4:

It can be observed that a roller is cylindrical.

Height (h) of cylindrical roller = Length of roller = 120 cm

Radius (r) of the circular end of roller = $\frac{84}{2}$ cm = 42 cm

CSA of roller = 2πrh

$= \left(2 \times \frac{22}{7} \times 42 \times 120\right) cm^2$

$= 31680 \text{ cm}^2$

Area of field = 500 × CSA of roller

$= (500 \times 31680) \text{ cm}^2$

$= 15840000 \text{ cm}^2$

$= 1584 \text{ m}^2$

Question 8:

In a hot water heating system, there is a cylindrical pipe of length 28 m and diameter 5 cm. Find the total radiating surface in the system. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 8:

Height (h) of cylindrical pipe = Length of cylindrical pipe = 28 m

Radius (r) of circular end of pipe = $\frac{5}{2}$ = 2.5 cm = 0.025 m

CSA of cylindrical pipe = 2πrh

$= \left(2 \times \frac{22}{7} \times 0.025 \times 28\right) m^2$

$= 4.4 \text{ m}^2$

The area of the radiating surface of the system is 4.4 m^2.

Question 9:

Find

(i) The lateral or curved surface area of a closed cylindrical petrol storage tank that is 4.2 m in diameter and 4.5 m high.

(ii) How much steel was actually used, if $\frac{1}{12}$ of the steel actually used was wasted in making the tank. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 9:

Height (h) of cylindrical tank = 4.5 m

Radius (r) of the circular end of cylindrical tank = $\left(\frac{4.2}{2}\right)$ m = 2.1 m

(i) Lateral or curved surface area of tank = 2πrh

$= \left(2 \times \frac{22}{7} \times 2.1 \times 4.5\right)$ m^2

= (44 × 0.3 × 4.5) m^2

= 59.4 m^2

Therefore, CSA of tank is 59.4 m^2.

(ii) Total surface area of tank = 2πr (r + h)

$= \left(2 \times \frac{22}{7} \times 2.1 \times (2.1 + 4.5)\right)$ m^2

= (44 × 0.3 × 6.6) m^2

= 87.12 m^2

Let A m^2 steel sheet be actually used in making the tank.

$\therefore A\left(1 - \frac{1}{12}\right) = 87.12$ m^2

$\Rightarrow A = \left(\frac{12}{11} \times 87.12\right)$ m^2

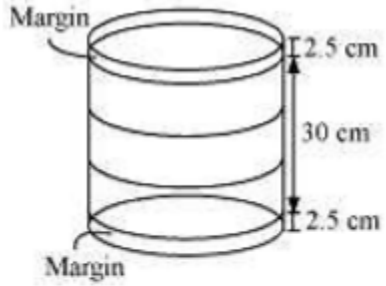
$\Rightarrow$ A = 95.04 m^2

Therefore, 95.04 m^2 steel was used in actual while making such a tank.

Question 10:

In the given figure, you see the frame of a lampshade. It is to be covered with a decorative cloth. The frame has a base diameter of 20 cm and height of 30 cm. A margin of 2.5 cm is to be given for folding it over the top and bottom of the frame. Find how much cloth is required for covering the lampshade. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 10:



Height (h) of the frame of lampshade = (2.5 + 30 + 2.5) cm = 35 cm

Radius (r) of the circular end of the frame of lampshade = $\frac{20}{2}$ cm = 10 cm

Cloth required for covering the lampshade = 2πrh

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

$= 2200 \text{ cm}^2$

Hence, for covering the lampshade, 2200 cm^2 cloth will be required.

Question 11:

The students of a Vidyalaya were asked to participate in a competition for making and decorating penholders in the shape of a cylinder with a base, using cardboard. Each penholder was to be of radius 3 cm and height 10.5 cm. The Vidyalaya was to supply the competitors with cardboard. If there were 35 competitors, how much cardboard was required to be bought for the competition? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 11:

Radius (r) of the circular end of cylindrical penholder = 3 cm

Height (h) of penholder = 10.5 cm

Surface area of 1 penholder = CSA of penholder + Area of base of penholder

$= 2\pi rh + \pi r^2$

$$= \left(2 \times \frac{22}{7} \times 3 \times 10.5 + \frac{22}{7} \times (3)^2\right) \text{ cm}^2$$

$$= \left(132 \times 1.5 + \frac{198}{7}\right) \text{ cm}^2$$

$$= \left(198 + \frac{198}{7}\right) \text{ cm}^2$$

$$= \frac{1584}{7} \text{ cm}^2$$

Area of cardboard sheet used by 1 competitor $= \frac{1584}{7}$ cm^2

Area of cardboard sheet used by 35 competitors $= \left(\frac{1584}{7} \times 35\right)$ cm^2

$= 7920$ cm^2

Therefore, 7920 cm^2 cardboard sheet will be bought.

ASSIGNMENT:

Complete the following questions from Exercise 13.2 of your NCERT book(page 216)

Q1, 3, 5, 6, 7

Link for reference:

https://www.youtube.com/watch?v=PSHuurBUT0A

https://www.youtube.com/watch?v=OyX-X9w5W1o

https://www.youtube.com/watch?v=sw6jqyoU2wQ

https://www.youtube.com/watch?v=q87gpVr6vIM

https://www.youtube.com/watch?v=bz_4vS6cYmw

DAY-2

LESSON DEVELOPMENT

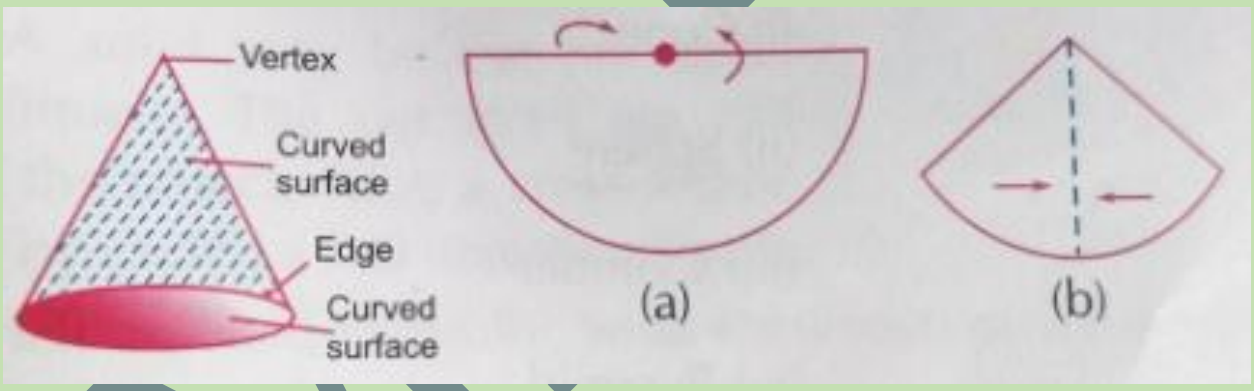
CONE

A solid having a curved surface and a flat (circular) face is called a cone.

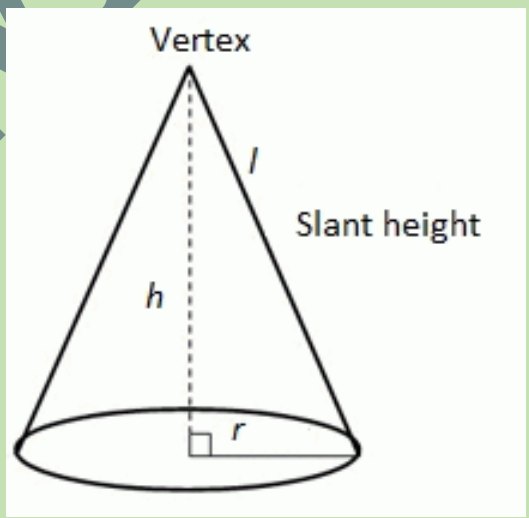
We can identify the shape of a cone in ice cream cone or clown's cap or conical tent

PROPERTIES OF CONE

- It has one vertex and one circular edge
- We can form a cone by cutting and folding a semi circular sheet of paper



RIGHT CIRCULAR CONE



In the give cone, let h be the height of right circular cone , r be the radius of the cone

Then slant height = $l = \sqrt{h^2 + r^2}$

Curved Surface area of right circular cone = πrl

Total Surface area of cone = $\pi rl + \pi r^2 = \pi r(l + r)$

Link:

https://www.youtube.com/watch?v=K2ghejiUDXg

EXERCISE 13.3

Question 3:

Curved surface area of a cone is 308 cm2 and its slant height is 14 cm. Find

(i) radius of the base and

(ii) total surface area of the cone. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 3:

(i) Slant height (l) of cone = 14 cm

Let the radius of the circular end of the cone be r.

We know, CSA of cone = πrl

$(308)\ \text{cm}^2 = \left(\frac{22}{7} \times r \times 14\right)\ \text{cm}$

$r = \frac{308}{44}\ \text{cm} = 7\ \text{cm}$

Therefore, the radius of the circular end of the cone is 7 cm.

(ii) Total surface area of cone = CSA of cone + Area of base

$= \pi rl + \pi r^2$

$= \left[308 + \frac{22}{7} \times (7)^2\right]\ \text{cm}^2$

$= (308 + 154)\ \text{cm}^2$

$= 462\ \text{cm}^2$

Therefore, the total surface area of the cone is 462 cm^2.

Question 5:

What length of tarpaulin 3 m wide will be required to make conical tent of height 8 m and base radius 6 m? Assume that the extra length of material that will be required for stitching margins and wastage in cutting is approximately 20 cm. [Use $\pi = 3.14$]

Solution 5:

Height (h) of conical tent = 8 m

Radius (r) of base of tent = 6 m

Slant height (l) of tent = $\sqrt{r^2 + h^2}$

$= \sqrt{6^2 + 8^2}$ m $= \sqrt{100}$ m = 10 m

CSA of conical tent = πrl

$= (3.14 \times 6 \times 10)\ m^2$

$= 188.4\ m^2$

Let the length of tarpaulin sheet required be l.

As 20 cm will be wasted, therefore, the effective length will be $(l - 0.2\ m)$.

Breadth of tarpaulin = 3 m

Area of sheet = CSA of tent

$[(l - 0.2\ m) \times 3]\ m = 188.4\ m^2$

$l - 0.2\ m = 62.8\ m$

$l = 63\ m$

Therefore, the length of the required tarpaulin sheet will be 63 m.

Question 8:

A bus stop is barricaded from the remaining part of the road, by using 50 hollow cones made of recycled cardboard. Each cone has a base diameter of 40 cm and height 1 m. If the outer side of each of the cones is to be painted and the cost of painting is Rs. 12 per m^2, what will be the cost of painting all these cones? (Use $\pi = 3.14$ and take $\sqrt{1.02} = 1.02$).

Solution 8:

Radius (r) of cone = $\frac{40}{2} = 20$ cm = 0.2 m

Height (h) of cone = 1 m

Slant height (l) of cone = $\sqrt{r^2 + h^2}$

= $\sqrt{(1)^2 + (0.2)^2}$ m = $\sqrt{1.04}$ m = 1.02 m

CSA of each cone = πrl

= $(3.14 \times 0.2 \times 1.02)$ m^2 = 0.64056 m^2

CSA of 50 such cones = (50×0.64056) m^2

= 32.028 m^2

Cost of painting 1 m^2 area = Rs. 12

Cost of painting 32.028 m^2 area = Rs. (32.028×12)

= Rs. 384.336

= Rs. 384.34 (approximately)

Therefore, it will cost Rs. 384.34 in painting 50 such hollow cones.

ASSIGNMENT:

Complete the following questions from Exercise 13.3 of your NCERT book(page 221)

Q1, 2, 4, 6, 7

Link for reference:

https://www.youtube.com/watch?v=cO4RI6vC51s

https://www.youtube.com/watch?v=Kt6Ew2085DU

https://www.youtube.com/watch?v=LW8bjE6u6Ew

https://www.youtube.com/watch?v=u0BfdbB6b0c

https://www.youtube.com/watch?v=Kk3E3QaBYlw

PRACTICE QUESTIONS:

Q1) Find the volume of cone of radius r/2 and height '2h'.

Q2) Find the capacity in litres of a conical vessel having height 8 cm and slant height 10 cm.

Q3) A right angled A ABC with sides 3 cm, 4 cm and 5 cm is revolved about the fixed side of 4 cm. find the volume of the solid generated. Also, find the total surface area of the solid.

Q4)

A conical tent is 10 m high and the radius of its base is 24 m. Find
(i) Slant height of the tent.
(ii) Cost of the canvas required to make the tent, if the cost of 1 m^2 canvas is ₹ 70.

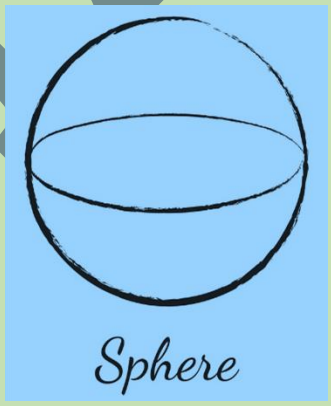
Q5)

A Joker's cap is in the form of a right circular cone of base radius 7cm and height 24cm. Find the area of the sheet required to make 10 such caps.

DAY-3

LESSON DEVELOPMENT

SPHERE



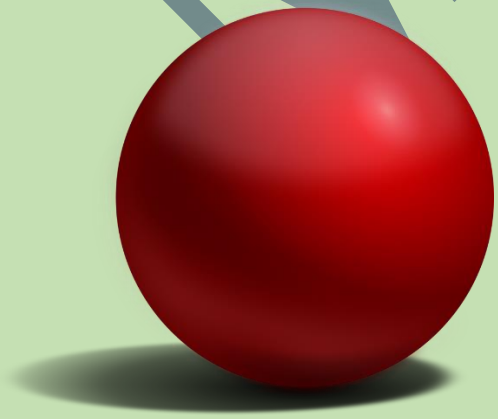
A solid which does not have any edge and a flat surface is called a sphere

It has only a curved surface.

It has no vertex also.

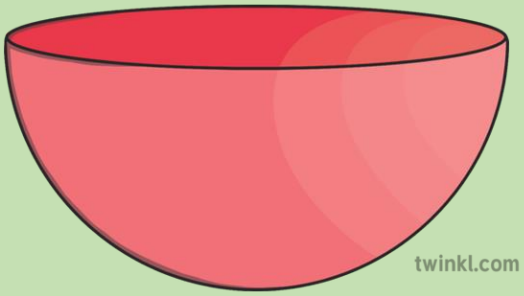
A sphere can be identified by the shape of a ball

SURFACE AREA OF SPHERE



Surface area of sphere = $4\pi r^2$

SURFACE AREA OF HEMISPHERE

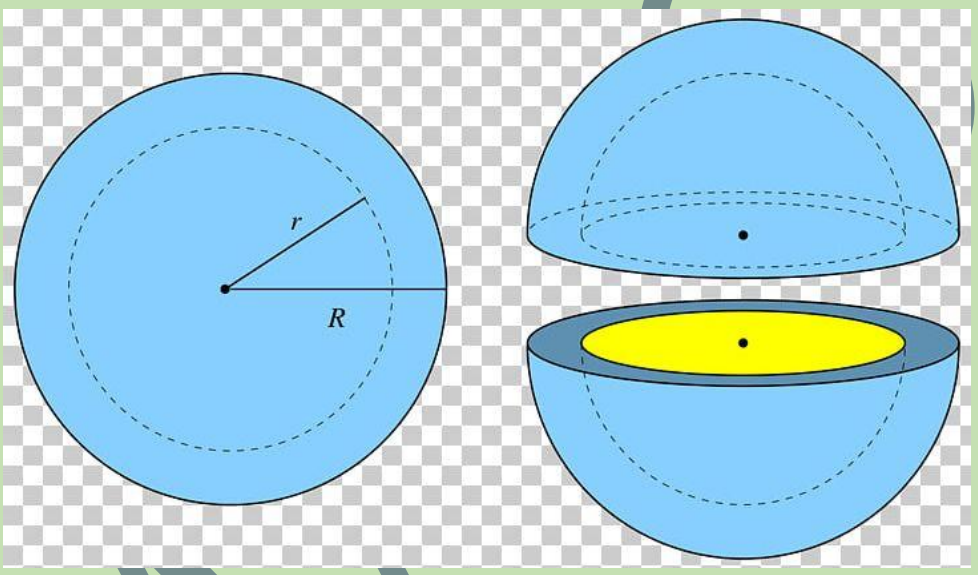


Curved surface area of hemisphere = $2\pi r^2$

Total surface area = $2\pi r^2 + \pi r^2$

$= 3\pi r^2$

SPHERICAL SHELL



Let R be the external radius and r be the internal radius of the spherical shell

External surface area = $4\pi R^2$

Internal surface area = $4\pi r^2$

Total surface area = $4\pi R^2 + 4\pi r^2$

Link:

https://www.youtube.com/watch?v=T_DBkFnr4NM

EXERCISE – 13.4

Question 3:

Find the total surface area of a hemisphere of radius 10 cm. [Use $\pi = 3.14$]

Solution 3:

Radius (r) of hemisphere = 10 cm

Total surface area of hemisphere = CSA of hemisphere + Area of circular end of hemisphere

$= 2\pi r^2 + \pi r^2$

$= 3\pi r^2$

$= [3 \times 3.14 \times (10)^2]\ cm^2$

$= 942\ cm^2$

Therefore, the total surface area of such a hemisphere is $942\ cm^2$.

Question 4:

The radius of a spherical balloon increases from 7 cm to 14 cm as air is being pumped into it. Find the ratio of surface areas of the balloon in the two cases.

Solution 4:

Radius (r_1) of spherical balloon = 7 cm

Radius (r_2) of spherical balloon, when air is pumped into it = 14 cm

$$\text{Required Ratio} = \frac{\text{Initial surface area}}{\text{Surface area after pumping air into ballon}}$$

$$= \frac{4\pi r_1^2}{4\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2$$

$$= \left(\frac{7}{14}\right)^2 = \frac{1}{4}$$

Therefore, the ratio between the surface areas in these two cases is 1:4.

Question 7:

The diameter of the moon is approximately one-fourth of the diameter of the earth. Find the ratio of their surface area.

Solution 7:

Let the diameter of earth be d. Therefore, the diameter of moon will be $\frac{d}{4}$.

Radius of earth $= \frac{d}{2}$

Radius of moon $= \frac{1}{2} \times \frac{d}{4} = \frac{d}{8}$

Surface area of moon $= 4\pi\left(\frac{d}{8}\right)^2$

Surface area of earth $= 4\pi\left(\frac{d}{2}\right)^2$

Required ratio $= \frac{4\pi\left(\frac{d}{8}\right)^2}{4\pi\left(\frac{d}{2}\right)^2}$

$= \frac{4}{64} = \frac{1}{16}$

Therefore, the ratio between their surface areas will be 1:16.

Question 8:

A hemispherical bowl is made of steel, 0.25 cm thick. The inner radius of the bowl is 5 cm. Find the outer curved surface area of the bowl. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 8:

Inner radius of hemispherical bowl = 5 cm

Thickness of the bowl = 0.25 cm

∴ Outer radius (r) of hemispherical bowl = (5 + 0.25) cm

= 5.25 cm

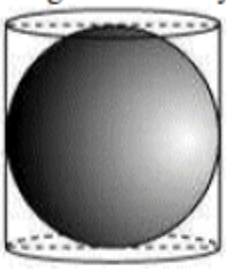
Outer CSA of hemispherical bowl = $2\pi r^2$

$= \left[2 \times \frac{22}{7} \times (5.25)^2\right]$ cm^2 = 173.25 cm^2

Therefore, the outer curved surface area of the bowl is 173.25 cm^2.

Question 9:

A right circular cylinder just encloses a sphere of radius r (see figure). Find

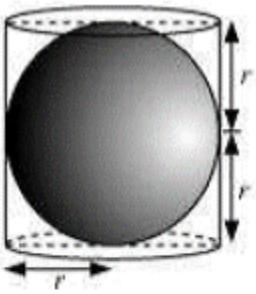


(i) surface area of the sphere,

(ii) curved surface area of the cylinder,

(iii) ratio of the areas obtained in (i) and (ii).

Solution 9:



(i) Surface area of sphere = $4\pi r^2$

(ii) Height of cylinder = r + r = 2r

Radius of cylinder = r

CSA of cylinder = $2\pi rh$

$= 2\pi r\,(2r)$

$= 4\pi r^2$

(iii) Required ratio = $\dfrac{\text{Surface area of sphere}}{\text{CSA of cylinder}}$

$= \dfrac{4\pi r^2}{4\pi r^2}$

$= \dfrac{1}{1}$

Therefore, the ratio between these two surface areas is 1:1.

ASSIGNMENT:

Complete the following questions from Exercise 13.4 of your NCERT book(page 225)

Q1, 2, 5, 6

Link for reference:

https://www.youtube.com/watch?v=y84sGta7T3o

https://www.youtube.com/watch?v=8-3QSdiLTRg

https://www.youtube.com/watch?v=znSbwt9bBhE

https://www.youtube.com/watch?v=scCYxUzH4Sg

PRACTICE QUESTIONS:

Q1) A shot-put is a metallic sphere of radius 4.9 cm. If the density of the metal is 7.8 g/cm3 . Find the mass of the shot-put.

Q2) A spherical ball is divided into two equal halves. If the curved surface area of each half is 56.57 cm2 , find the volume of the spherical ball. [use π = 3.14]

EXTRA QUESTIONS:

Q1)

Find the curved surface area of the cylinder whose circumference of the base is 22 cm and height is 3m:

(a) $44cm^2$
(b) $66\ cm^2$
(c) $77cm^2$
(d) $22cm^2$

Q2)

Total surface area of a cone whose radius as p/2 and slant height as 2l is:

(a) $2\pi p(l+p)$
(b) $\pi p(l+\frac{p}{4})$
(c) $\pi p(l+p)$
(d) $2\pi pl$

Q3)

If the slant height of a cone 12cm and radius of the base is 14 cm, then the total surface area is ----------.

Q4)

A solid right cylinder cone is cut into two parts at the middle of its height by a plane parallel toits base. The ratio of the volume of the smaller cone to the whole cone is:------

Q5)

If the lateral surface of a cylinder is 94.2 sq.cm and its height is 5 cm, then find radius of its base.

Q6)

.The slant height of a cone is 26 cm and base diameter is 20 cm. Find its height

Q7)

.The radius and height of a cone are in the ratio 4:3. The area of the base is 154 cm^2. Find the curved surface area.

Q8)

.There are two cones, the curved surface area of one cone is twice that of the other. The slant height of later is twice that of the former. Find the ratio of their radii.

Q9)

.In a hot water heating system there is a cylindrical pipe of length 28 m and diameter 5 cm. Find the total radiating surface area in the system.

Q10)

The ratio of total surface area and curved surface area of a cylinder is 2:1 ,if the total surface area is 616 cm^2, find the radius and height of the cylinder.

Q11)

A well of 14m deep is having 2m in radius. Find the cost of cementing the inner curved surface area at the rate of Rs. 2 per m^2.

Q12)

.The difference between outside and inside surface of a cylindrical metallic pipe 14m long is 44 cm^2. If the sum of the diameters of the inner and outer surface of the cylinder is 9 cm, find the inner and outer radii of the cylinder

Q13)

The diameter of a roller is 250 cm and length is 140 cm. If it takes 500 complete revolutions to level a play-ground , determine the cost of levelling at the rate of 50 paise per square meter.

Week : 25 January 2021 to 30 January 2021

Number of blocks: 4

CHAPTER-13 : SURFACE AREAS AND VOLUMES (part-3)

Sub-Topics:

- Volume of cube and cuboid
- Volume of right circular cylinder
- Volume of right circular cone
- Volume area of sphere

Link for the chapter: https://ncert.nic.in/textbook.php?iemh1=13-15

Learning Outcomes:

Each student will be able to:

- find volume of cube and cuboid
- find volume of right circular cylinder
- find volume of right circular cone
- find volume of sphere
- apply the knowledge gained in real life

Teaching Aids Used:

Presentation of E-lesson, YouTube videos by screen sharing, white board and marker using laptop/mobile

GUIDELINES:

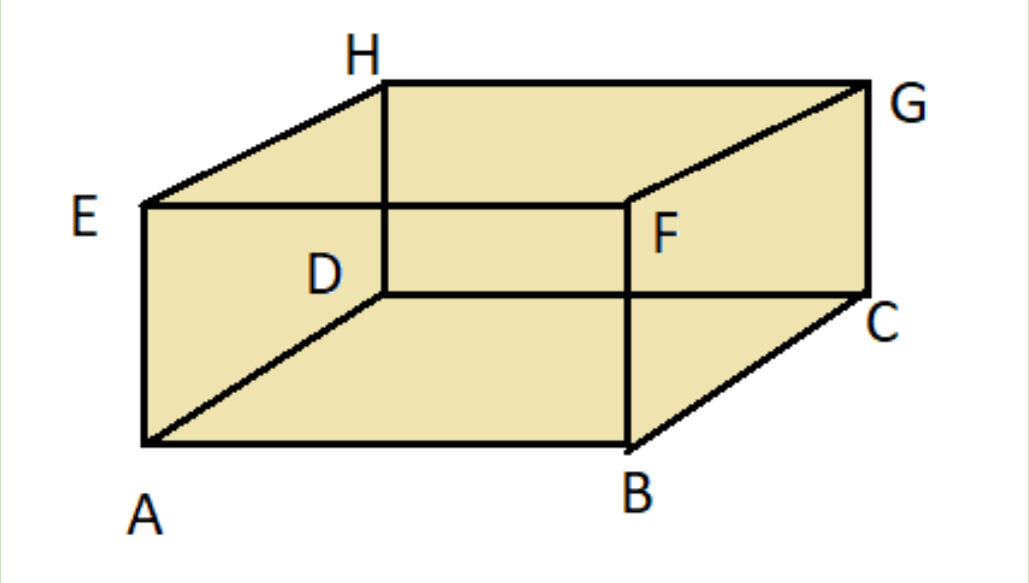
Dear students,

Kindly read the content given below and view the links shared for better understanding.

Solve the given questions in math notebook.

VOLUME OF CUBOID AND CUBE

CUBOID



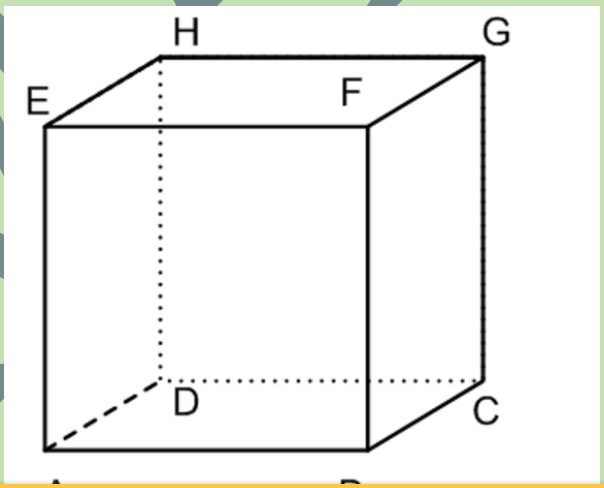
Volume of Cuboid = $length \times breadth \times height$

$= lbh$

Link:

https://www.youtube.com/watch?v=7E_MHi4OwUc

CUBE



Volume of Cube = $edge \times edge \times edge$

$= a^3$

Link:

https://www.youtube.com/watch?v=VvfjrYiw41I

EXAMPLE:

A wall of length 10 m was to be built across an open ground. The height of the wall is 4 m and thickness of the wall is 24 cm. If this wall is to be built up with bricks whose dimensions are 24 cm × 12 cm × 8 cm, how many bricks would be required?

SOLUTION:

Since the wall with all its bricks makes up the space occupied by it, we need to find the volume of the wall, which is nothing but a cuboid.

Here,

Length = 10 m = 1000 cm

Thickness = 24 cm

Height = 4 m = 400 cm

Therefore,

Volume of the wall = length × thickness × height

$$= 1000 \times 24 \times 400\, cm^3$$

Now, each brick is a cuboid with length = 24 cm, breadth = 12 cm and height = 8 cm

So, volume of each brick = length × breadth × height

$$= 24 \times 12 \times 8\, cm^3$$

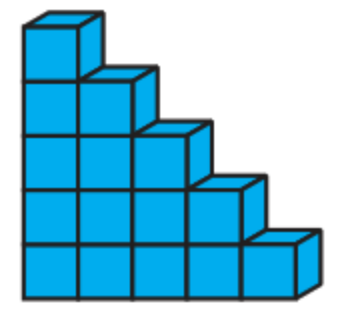
So, number of bricks required $= (volume\ of\ the\ wall)/(volume\ of\ each\ brick)$

$$= (1000 \times 24 \times 400)/(24 \times 12 \times 8) = 4166.6$$

So, the wall requires 4167 bricks.

EXAMPLE:

A child playing with building blocks, which are of the shape of cubes, has built a structure as shown in figure. If the edge of each cube is 3 cm, find the volume of the structure built by the child.



SOLUTION

Volume of each cube = edge × edge × edge

$$= 3 \times 3 \times 3\ cm^3$$

$$= 27\ cm^3$$

Number of cubes in the structure = 15

Therefore, volume of the structure = $27 \times 15\ cm^3$

$$= 405\ cm^3$$

EXERCISE – 13.5

Question 2:

A cuboidal water tank is 6 m long, 5 m wide and 4.5 m deep. How many litres of water can it hold? ($1\ m^3 = 1000l$)

Solution 2:

The given cuboidal water tank has its length (l) as 6 m, breadth (b) as 5 m, and height (h) as 4.5 m.

Volume of tank = l × b × h

$= (6 \times 5 \times 4.5)\ m^3 = 135\ m^3$

Amount of water that $1\ m^3$ volume can hold = 1000 litres

Amount of water that $135\ m^3$ volume can hold = (135 × 1000) litres = 135000 litres

Therefore, such tank can hold up to 135000 litres of water.

Question 4:

Find the cost of digging a cuboidal pit 8 m long, 6 m broad and 3 m deep at the rate of Rs 30 per m^3.

Solution 4:

The given cuboidal pit has its length (l) as 8 m, width (b) as 6 m, and depth (h) as 3 m.

Volume of pit = l × b × h

= (8 × 6 × 3) m^3 = 144 m^3

Cost of digging per m^3 volume = Rs. 30

Cost of digging 144 m^3 volume = Rs. (144 × 30) = Rs. 4320.

Question 6:

A village, having a population of 4000, requires 150 litres of water per head per day. It has a tank measuring 20 m × 15 m × 6 m. For how many days will the water of this tank last?

Solution 6:

The given tank is cuboidal in shape having its length (l) as 20 m, breadth (b) as 15 m, and height (h) as 6 m.

Capacity of tank = l × b× h

= (20 × 15 × 6) m^3 = 1800 m^3 = 1800000 litres

Water consumed by the people of the village in 1 day = (4000 × 150) litres

= 600000 litres

Let water in this tank last for n days.

Water consumed by all people of village in *n* days = Capacity of tank

n × 600000 = 1800000

n = 3

Therefore, the water of this tank will last for 3 days.

Question 8:

A solid cube of side 12 cm is cut into eight cubes of equal volume. What will be the side of the new cube? Also, find the ratio between their surface areas.

Solution 8:

Side (a) of cube = 12 cm

Volume of cube = $(a)^3 = (12\ cm)^3 = 1728\ cm^3$

Let the side of the smaller cube be a_1.

Volume of 1 smaller cube = $\frac{1728}{8}\ cm^3 = 216\ cm^3$

$(a_1)^3 = 216\ cm^3$

$\Rightarrow a_1 = 6$ cm

Therefore, the side of the smaller cubes will be 6 cm.

Ratio between surface areas of cubes = $\frac{\text{Surface area of bigger cube}}{\text{Surface area of smaller cube}}$

$$= \frac{6a^2}{6a_1^{\ 2}} = \frac{12^2}{6^2}$$

$$= \frac{4}{1}$$

Therefore, the ratio between the surface areas of these cubes is 4:1.

Question 9:

A river 3 m deep and 40 m wide is flowing at the rate of 2 km per hour. How much water will fall into the sea in a minute?

Solution 9:

Rate of water flow = 2 km per hour

$= \left(\frac{2000}{60}\right)$ m/min

$= \left(\frac{100}{3}\right)$ m/min

Depth (h) of river = 3 m

Width (b) of river = 40 m

Volume of water flowed in 1 min $= \left(\frac{100}{3} \times 40 \times 3\right)$ $m^3 = 4000$ m^3

Therefore, in 1 minute, 4000 m^3 water will fall in the sea.

EXTRA QUESTIONS:

Q1. If a wooden box of dimensions 8 m x 7 m x 6 m is to carry boxes of dimensions 8 cm x 7 cm x 6 cm, then find the maximum number

of boxes that can be carried in the wooden box.

Q2. A cube with an edge of 7 cm and a cuboid measuring 7 cm × 4 cm × 8 am are kept on a table. Which shape has more volume?

Q3. A cuboid is 9 cm long, 5 cm broad and 4 cm high and a cube has an edge of 5 cm. Which one has greater volume?

Q4. What is the volume of a brick of ice-cream in litres with length 25 cm, breadth 10 cm and height 8 cm?

Q5. A brick measures 15 cm in length, 8 cm in breadth and 5 cm in height. How many bricks will be used to make a wall of length 15 m, breadth 10 m and height 8 metres?

Q6. A pond is 50 m long, 30 m wide and 2 m deep. Find the capacity of the pond in litres.

ASSIGNMENT:

Complete the following questions from Exercise 13.5 of your NCERT book(page 228)

Q1, 3, 5, 7

Link for reference:

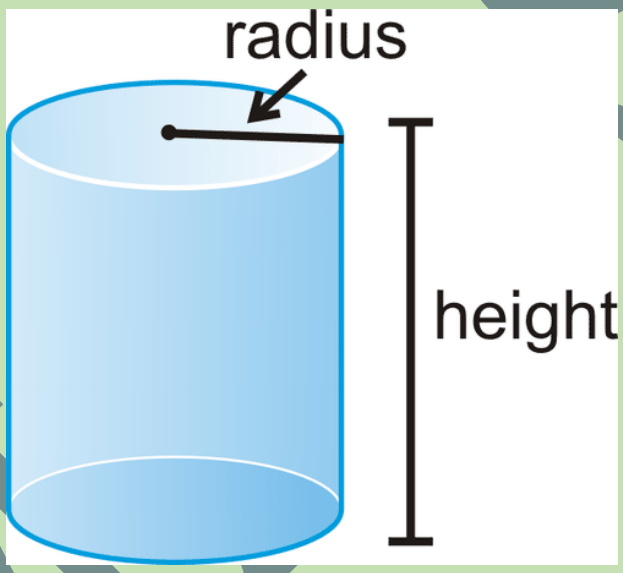
https://www.youtube.com/watch?v=SQrzpdLs-oQ

https://www.youtube.com/watch?v=nxXRZZZq-Mg

https://www.youtube.com/watch?v=YKMy8t3ak1I

https://www.youtube.com/watch?v=MvarlfosEcw

VOLUME OF RIGHT CIRCULAR CYLINDER

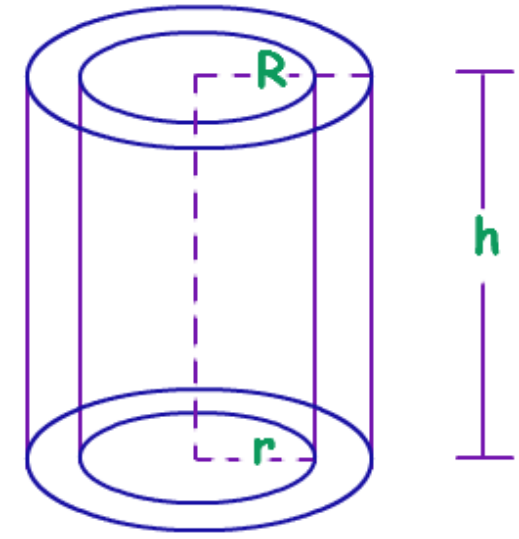


Volume of cylinder = $\pi r^2 h$

Link:

https://www.youtube.com/watch?v=2JdqlRdRg6w

VOLUME OF HOLLOW CYLINDER



Volume of hollow cylinder = External Volume – Internal Volume

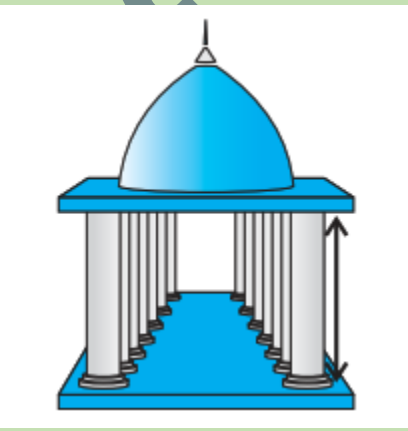
$$= \pi R^2 h - \pi r^2 h = \pi h(R^2 - r^2)$$

Link:

https://www.youtube.com/watch?v=YP4n4L92wUs

EXAMPLE

The pillars of a temple are cylindrically shaped. If each pillar has a circular base of radius 20 cm and height 10 m, how much concrete mixture would be required to build 14 such pillars?



SOLUTION

Since the concrete mixture that is to be used to build up the pillars is going to occupy the entire space of the pillar, what we need to find here is the volume of the cylinders.

Radius of base of a cylinder = 20 cm

Height of the cylindrical pillar = 10 m = 1000 cm

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

$$= \frac{22}{7} \times 20 \times 20 \times 1000 \text{ cm}^3$$

$$= \frac{8800000}{7} \text{ cm}^3$$

$$= \frac{8.8}{7} \text{ m}^3 \text{ (Since } 1000000 \text{ cm}^3 = 1\text{m}^3\text{)}$$

Therefore, volume of 14 pillars = volume of each cylinder × 14

$$= \frac{8.8}{7} \times 14 \text{ m}^3$$

$$= 17.6 \text{ m}^3$$

So, 14 pillars would need $17.6\ m^3$ of concrete mixture.

EXAMPLE

At a Ramzan Mela, a stall keeper in one of the food stalls has a large cylindrical vessel of base radius 15 cm filled up to a height of 32 cm with orange juice. The juice is filled in small cylindrical glasses of radius 3 cm up to a height of 8 cm, and sold for Rs 3 each. How much money does the stall keeper receive by selling the juice completely?

SOLUTION

The volume of juice in the vessel = volume of the cylinderical vessel

$$= \pi R^2 H$$

(where R and H are taken as the radius and height respectively of the vessel)

$$= \pi \times 15 \times 15 \times 32\ cm^3$$

Similarly, the volume of juice each glass can hold = $\pi r^2 h$

(where r and h are taken as the radius and height respectively of each glass)

$= \pi \times 3 \times 3 \times 8 \text{ cm}^3$

So, number of glasses of juice that are sold

$$= \frac{\text{volume of the vessel}}{\text{volume of each glass}}$$

$$= \frac{\pi \times 15 \times 15 \times 32}{\pi \times 3 \times 3 \times 8}$$

$= 100$

Therefore, amount received by the stall keeper = Rs 3×100

= Rs 300

EXERCISE 13.6

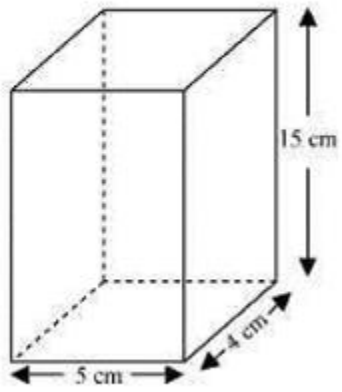
Question 3:

A soft drink is available in two packs – (i) a tin can with a rectangular base of length 5 cm and width 4 cm, having a height of 15 cm and (ii) a plastic cylinder with circular base of diameter 7 cm and height 10 cm. Which container has greater capacity and by how much?

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

Solution 3:

The tin can will be cuboidal in shape while the plastic cylinder will be cylindrical in shape.



Length (l) of tin can = 5 cm

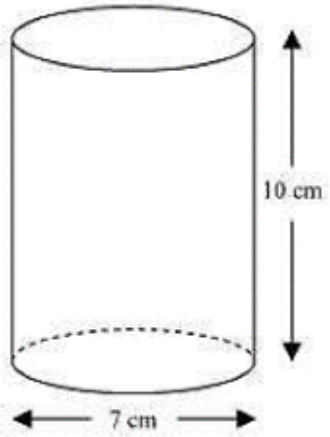
Breadth (b) of tin can = 4 cm

Height (h) of tin can = 15 cm

Capacity of tin can = $l \times b \times h$

$= (5 \times 4 \times 15)\ cm^3$

$= 300\ cm^3$



Radius (r) of circular end of plastic cylinder = $\frac{7}{2}$ cm = 3.5 cm

Height (H) of plastic cylinder = 10 cm

Capacity of plastic cylinder = $\pi r^2 h$

$= \left[\frac{22}{7} \times (3.5)^2 \times 10\right]\ cm^3$

$= 11 \times 35\ cm^3$

$= 385\ cm^3$

Therefore, plastic cylinder has the greater capacity.

Difference in capacity = $(385 - 300)\ cm^3 = 85\ cm^3$

Question 4:

If the lateral surface of a cylinder is 94.2 cm^2 and its height is 5 cm, then find

(i) radius of its base

(ii) its volume. [Use $\pi = 3.14$]

Solution 4:

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

Let radius of cylinder be r.

CSA of cylinder = 94.2 cm^2

$2\pi rh = 94.2\ cm^2$

$(2 \times 3.14 \times r \times 5)\ cm = 94.2\ cm^2$

r = 3 cm

(ii) Volume of cylinder = $\pi r^2 h$

$= (3.14 \times (3)^2 \times 5)\ cm^3$

$= 141.3\ cm^3$

Question 5:

It costs Rs. 2200 to paint the inner curved surface of a cylindrical vessel 10 m deep. If the cost of painting is at the rate of Rs. 20 per m^2, find

(i) Inner curved surface area of the vessel

(ii) Radius of the base

(iii) Capacity of the vessel $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 5:

(i) Rs. 20 is the cost of painting 1 m^2 area.

Rs. 2200 is the cost of painting = $\left(\frac{1}{20} \times 2200\right)$ m^2 area

= 110 m^2 area

Therefore, the inner surface area of the vessel is 110 m^2.

(ii) Let the radius of the base of the vessel be r.

Height (h) of vessel = 10 m

Surface area = $2\pi rh = 110$ m^2

$$\Rightarrow \left[2 \times \frac{22}{7} \times r \times 10\right] \text{ m} = 110 \text{ m}^2$$

$$\Rightarrow r = \frac{7}{4} \text{ m} = 1.75 \text{ m}$$

(iii) Volume of vessel = $\pi r^2 h$

$$= \left[\frac{22}{7} \times (1.75)^2 \times 10\right] \text{ m}^3$$

= 96.25 m^3

Therefore, the capacity of the vessel is 96.25 m^3 or 96250 litres.

Question 6:

The capacity of a closed cylindrical vessel of height 1 m is 15.4 litres. How many square metres of metal sheet would be needed to make it? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 6:

Let the radius of the circular end be r.

Height (h) of cylindrical vessel = 1 m

Volume of cylindrical vessel = 15.4 litres = 0.0154 m^3

$\pi r^2 h = 0.0154\ m^3$

$\left(\frac{22}{7} \times r^2 \times 1\right) m = 0.0154\ m^3$

$\Rightarrow r = 0.07\ m$

Total surface area of vessel = $2\pi r(r + h)$

$= \left[2 \times \frac{22}{7} \times 0.07(0.07 + 1)\right] m^2$

$= 0.44 \times 1.07\ m^2$

$= 0.4708\ m^2$

Therefore, 0.4708 m^2 of the metal sheet would be required to make the cylindrical vessel.

ASSIGNMENT:

Complete the following questions from Exercise 13.6 of your NCERT book(page 230)

Q1, 2, 7, 8

Link for reference:

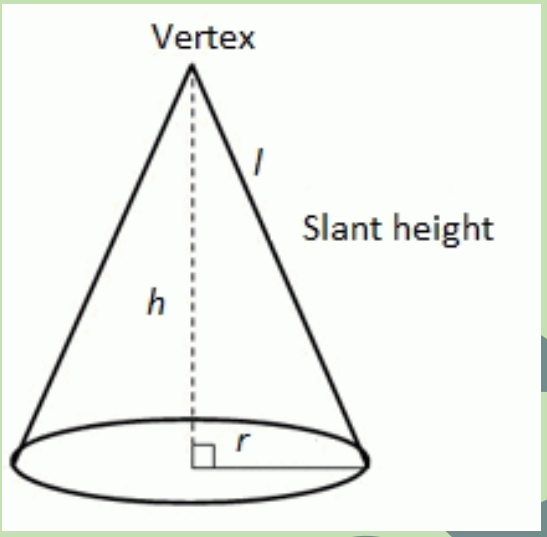
https://www.youtube.com/watch?v=bpITeAF9cac

https://www.youtube.com/watch?v=VxQp-O3gko4

https://www.youtube.com/watch?v=dfzbrOvG33k

https://www.youtube.com/watch?v=gmyBJF1gZdM

VOLUME OF RIGHT CIRCULAR CONE



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

Link:

https://www.youtube.com/watch?v=ifaf_1yYbvo&t=49s

EXAMPLE

The height and the slant height of a cone are 21 cm and 28 cm respectively. Find the volume of the cone.

SOLUTION

From $l^2 = r^2 + h^2$, we have

$$r = \sqrt{l^2 - h^2} = \sqrt{28^2 - 21^2}\ \text{cm} = 7\sqrt{7}\ \text{cm}$$

$$\text{So, volume of the cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 7\sqrt{7} \times 7\sqrt{7} \times 21\ \text{cm}^3$$

$$= 7546\ \text{cm}^3$$

EXAMPLE

Monica has a piece of canvas whose area is $551\ m^2$. She uses it to have a conical tent made, with a base radius of 7 m. Assuming that all the stitching margins and the wastage incurred while cutting, amounts to approximately1 m^2, find the volume of the tent that can be made with it.

SOLUTION

Since the area of the canvas = 551 m^2 and area of the canvas lost in wastage is 1 m^2, therefore the area of canvas available for making the tent is (551 – 1) m^2 = 550 m^2.

Now, the surface area of the tent = 550 m^2 and the required base radius of the conical tent = 7 m

Note that a tent has only a curved surface (the floor of a tent is not covered by canvas!!).

Therefore, curved surface area of tent = 550 m^2.

That is, $\pi rl = 550$

or, $\frac{22}{7} \times 7 \times l = 550$

or, $l = 3\frac{550}{22}\text{ m} = 25\text{ m}$

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

Therefore, $h = \sqrt{l^2 - r^2} = \sqrt{25^2 - 7^2}\text{ m} = \sqrt{625 - 49}\text{ m} = \sqrt{576}\text{ m}$

$= 24\text{ m}$

So, the volume of the conical tent $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 24\text{ m}^3 = 1232\text{ m}^3$.

EXERCISE – 13.7

Question 3:

The height of a cone is 15 cm. If its volume is 1570 cm3, find the diameter of its base. [Use π = 3.14]

Solution 3:

Height (h) of cone = 15 cm

Let the radius of the cone be r.

Volume of cone = 1570 cm^3

$\frac{1}{3}\pi r^2 h = 1570\text{ cm}^3$

$\Rightarrow \left[\frac{1}{3} \times 3.14 \times r^2 \times 15\right]\text{ cm} = 1570\text{ cm}^3$

$\Rightarrow r^2 = 100\text{ cm}^2$

$\Rightarrow r = 10\text{ cm}$

Therefore, the radius of the base of cone is 10 cm.

Question 4:

If the volume of a right circular cone of height 9 cm is 48π cm3, find the diameter of its base.

Solution 4:

Height (h) of cone = 9 cm

Let the radius of the cone be r.

Volume of cone = 48π cm^3

$\frac{1}{3}\pi r^2 h = 48\pi \text{ cm}^3$

$\Rightarrow \left[\frac{1}{3}\pi r^2 \times 9\right] \text{ cm} = 48\pi \text{ cm}^3$

$\Rightarrow r^2 = 16 \text{ cm}^2$

$\Rightarrow r = 4 \text{ cm}$

Diameter of base = 2r = 8 cm

Question 5:

A conical pit of top diameter 3.5 m is 12 m deep. What is its capacity in kilolitres?

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

Solution 5:

Radius (r) of pit = $\frac{3.5}{2}$ m = 1.75 m

Height (h) of pit = Depth of pit = 12 m

Volume of pit = $\frac{1}{3}\pi r^2 h$

$= \left[\frac{1}{3} \times \frac{22}{7} \times (1.75)^2 \times 12\right] \text{ cm}^3$

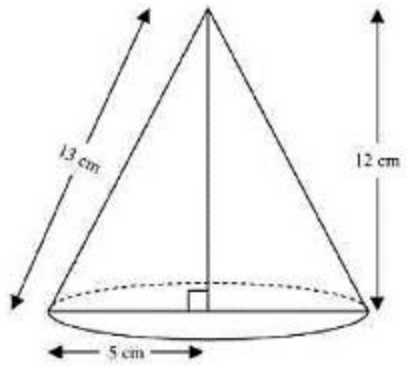
$= 38.5 \text{ m}^3$

Thus, capacity of the pit = (38.5 × 1) kilolitres = 38.5 kilolitres

Question 7:

A right triangle ABC with sides 5 cm, 12 cm and 13 cm is revolved about the side 12 cm. Find the volume of the solid so obtained.

Solution 7:



When right-angled ΔABC is revolved about its side 12 cm, a cone with height (h) as 12 cm, radius (r) as 5 cm, and slant height (l) 13 cm will be formed.

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

$= \left[\frac{1}{3} \times \pi \times (5)^2 \times 12\right]$ cm^3

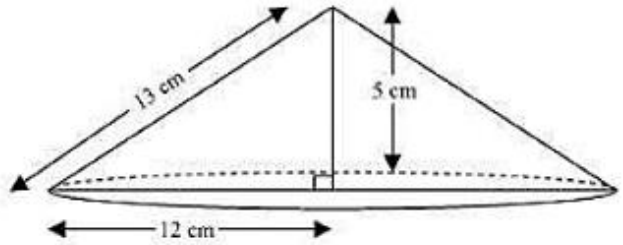
$= 100\pi$ cm^3

Therefore, the volume of the cone so formed is 100π cm^3.

Question 8:

If the triangle ABC in the Question 7 above is revolved about the side 5 cm, then find the volume of the solid so obtained. Find also the ratio of the volumes of the two solids obtained in Questions 7 and 8.

Solution 8:



When right-angled ΔABC is revolved about its side 5 cm, a cone will be formed having radius (r) as 12 cm, height (h) as 5 cm, and slant height (l) as 13 cm.

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

$= \left[\frac{1}{3} \times \pi \times (12)^2 \times 5\right]$ cm^3

$= 240\pi$ cm^3

Therefore, the volume of the cone so formed is 240π cm^3.

ASSIGNMENT:

Complete the following questions from Exercise 13.7 of your NCERT book(page 233)

Q1, 2, 6, 9

Link for reference:

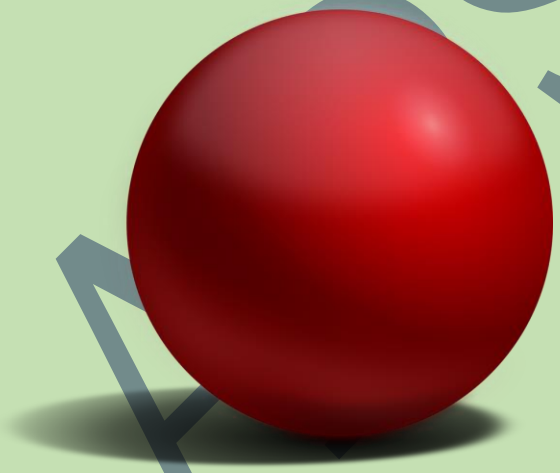
https://www.youtube.com/watch?v=FjbHohefpgc

https://www.youtube.com/watch?v=fL945PuQ2-g

https://www.youtube.com/watch?v=Pa886Rv2LQY

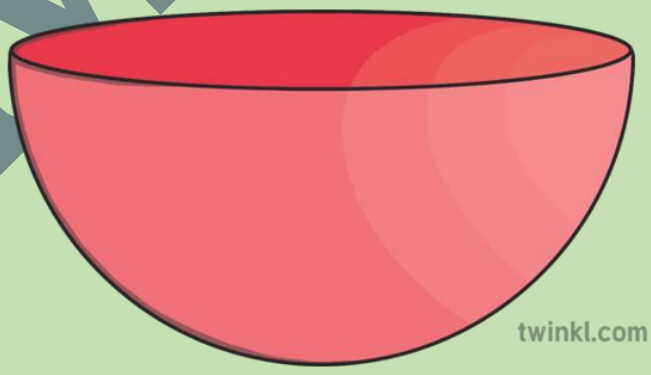
https://www.youtube.com/watch?v=IK79wxClDfo

VOLUME OF SPHERE



Volume of sphere = $\frac{4}{3}\pi r^3$

VOLUME OF HEMISPHERE



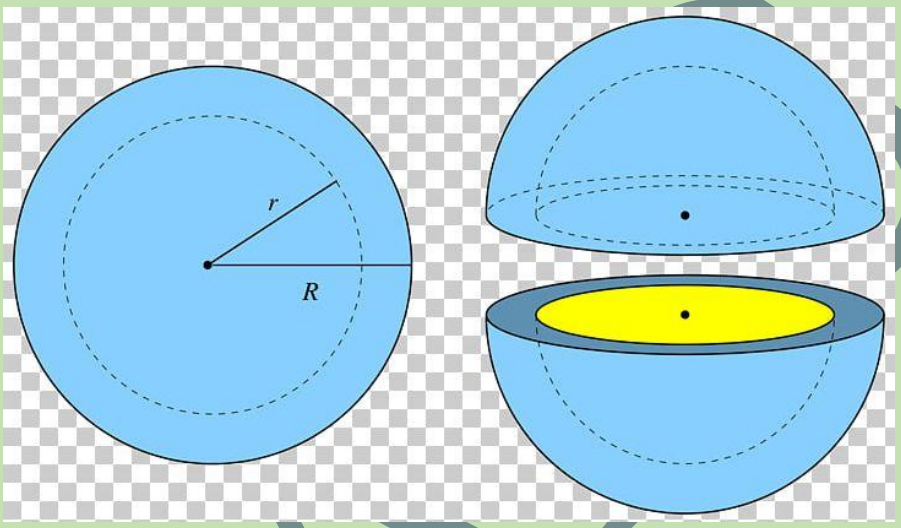
Volume of hemisphere = $\frac{2}{3}\pi r^3$

Link:

https://www.youtube.com/watch?v=_A-j2dFmWC0

VOLUME OF SPHERICAL SHELL

Let R be the external radius and r be the internal radius of the spherical shell



Volume of spherical shell

$$= \frac{4}{3}\pi(R^3 - r^3)$$

EXERCISE – 13.8

Question 3:

The diameter of a metallic ball is 4.2 cm. What is the mass of the ball, if the density of the metal is 8.9 g per cm^3? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 3:

Radius (r) of metallic ball $= \frac{4.2}{2}$ cm $= 2.1$ cm

Volume of metallic ball $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times (2.1)^3$ cm^3

$= 38.808\ \text{cm}^3$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Mass = Density × Volume

$= (8.9 \times 38.808)\ \text{g}$

$= 345.3912\ \text{g}$

Hence, the mass of the ball is 345.39 g (approximately).

Question 4:

The diameter of the moon is approximately one-fourth of the diameter of the earth. What fraction of the volume of the earth is the volume of the moon?

Solution 4:

Let the diameter of earth be d. Therefore, the radius of earth will be $\frac{d}{2}$.

Diameter of moon will be $\frac{d}{4}$ and the radius of moon will be $\frac{d}{8}$.

$$\text{Volume of moon} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi\left(\frac{d}{8}\right)^3 = \frac{1}{512} \times \frac{4}{3}\pi d^3$$

$$\text{Volume of earth} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3 = \frac{1}{8} \times \frac{4}{3}\pi d^3$$

$$\frac{\text{Volume of moon}}{\text{Volume of earth}} = \frac{\frac{1}{512} \times \frac{4}{3}\pi d^3}{\frac{1}{8} \times \frac{4}{3}\pi d^3} = \frac{1}{64}$$

$$\text{Volume of moon} = \frac{1}{64}\text{Volume of earth}$$

Therefore, the volume of moon is $\frac{1}{64}$ of the volume of earth.

Question 5:

How many litres of milk can a hemispherical bowl of diameter 10.5 cm hold? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 5:

Radius (r) of hemispherical bowl $= \frac{10.5}{2}$ cm = 5.25 cm

Volume of hemispherical bowl = $\frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \frac{22}{7} \times (5.25)^3$ cm³

= 303.1875 cm³

Capacity of the bowl = $\frac{303.1875}{1000}$ litre

= 0.3031875 litre

= 0.303 litre (approximately)

Therefore, the volume of the hemispherical bowl is 0.303 litre.

Question 6:

A hemispherical tank is made up of an iron sheet 1 cm thick. If the inner radius is 1 m, then find the volume of the iron used to make the tank. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 6:

Inner radius (r_1) of hemispherical tank = 1 m

Thickness of hemispherical tank = 1 cm = 0.01 m

Outer radius (r_2) of hemispherical tank = (1 + 0.01) m = 1.01 m

Volume of iron used to make such a tank = $\frac{2}{3}\pi(r_2^3 - r_1^3)$

$= \left[\frac{2}{3} \times \frac{22}{7} \times \{(1.01)^3 - (1)^3\}\right]$ m³

$= \left[\frac{44}{21} \times \{1.030301 - 1\}\right]$ m³

= 0.06348 m³ (approximately).

Question 7:

Find the volume of a sphere whose surface area is 154 cm². $\left[\text{Assume } \pi = \frac{22}{7}\right]$

Solution 7:

Let radius of sphere be r.

Surface area of sphere = 154 cm^2

$\Rightarrow 4\pi r^2 = 154\ cm^2$

$\Rightarrow r^2 = \left(\frac{154\times 7}{4\times 22}\right)\ cm^2$

$\Rightarrow r = \left(\frac{7}{2}\right)\ cm = 3.5\ cm$

Volume of sphere = $\frac{4}{3}\pi r^3$

$= \frac{4}{3}\times\frac{22}{7}\times(3.5)^3\ cm^3$

$= 179\frac{2}{3}\ cm^3$

Therefore, the volume of the sphere is $179\frac{2}{3}\ cm^3$.

Question 9:

Twenty-seven solid iron spheres, each of radius r and surface area S are melted to form a sphere with surface area S'. Find the

(i) radius r' of the new sphere,

(ii) ratio of S and S'.

Solution 9:

(i)Radius of 1 solid iron sphere = r

Volume of 1 solid iron sphere = $\frac{4}{3}\pi r^3$

Volume of 27 solid iron spheres = $27 \times \frac{4}{3}\pi r^3$

27 solid iron spheres are melted to form 1 iron sphere. Therefore, the volume of this iron sphere will be equal to the volume of 27 solid iron spheres. Let the radius of this new sphere be r'.

Volume of new solid iron sphere = $\frac{4}{3}\pi r'^3$

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

$r'^3 = 27r^3$

$r' = 3r$

(ii) Surface area of 1 solid iron sphere of radius r = $4\pi r^2$

Surface area of iron sphere of radius r' = $4\pi(r')^2$

= $4\pi(3r)^2 = 36\ \pi r^2$

$\frac{S}{S'} = \frac{4\pi r^2}{36\pi r^2} = \frac{1}{9} = 1:9$

ASSIGNMENT:

Complete the following questions from Exercise 13.8 of your NCERT book(page 236)

Q1, 2, 8, 10

Link for reference:

https://www.youtube.com/watch?v=xb6VV7zc_v4

https://www.youtube.com/watch?v=cNFitq2vz3s

https://www.youtube.com/watch?v=UySQWvZjJj4

https://www.youtube.com/watch?v=4jbgsryrOPA

EXTRA QUESTIONS:

Q1) In a cylinder, if radius is halved and height is doubled, the volume will be

(A) same (B) doubled (C) halved (D) four times

Q2)

The radius of a sphere is $2r$, then its volume will be

(A) $\frac{4}{3}\pi r^3$ (B) $4\pi r^3$ (C) $\frac{8\pi r^3}{3}$ (D) $\frac{32}{3}\pi r^3$

Q3)

The total surface area of a cube is 96 cm^2. The volume of the cube is:

(A) 8 cm^3 (B) 512 cm^3 (C) 64 cm^3 (D) 27 cm^3

Q4)

A cone is 8.4 cm high and the radius of its base is 2.1 cm. It is melted and recast into a sphere. The radius of the sphere is :

(A) 4.2 cm (B) 2.1 cm (C) 2.4 cm (D) 1.6 cm

Q5)

In a cylinder, radius is doubled and height is halved, curved surface area will be

(A) halved (B) doubled (C) same (D) four times

Q6)

The total surface area of a cone whose radius is $\frac{r}{2}$ and slant height $2l$ is

(A) $2\pi r\,(l + r)$ (B) $\pi r\,(l + \frac{r}{4})$ (C) $\pi r\,(l + r)$ (D) $2\pi rl$

Q7)

The lateral surface area of a cube is 256 m^2. The volume of the cube is

(A) 512 m^3 (B) 64 m^3 (C) 216 m^3 (D) 256 m^3

Q8)

The radii of two cylinders are in the ratio of 2:3 and their heights are in the ratio of 5:3. The ratio of their volumes is:

(A) 10 : 17 (B) 20 : 27 (C) 17 : 27 (D) 20 : 37

Q9)

The radius of a hemispherical balloon increases from 6 cm to 12 cm as air is being pumped into it. The ratios of the surface areas of the balloon in the two cases is

(A) 1 : 4 (B) 1 : 3 (C) 2 : 3 (D) 2 : 1

Q10)

The length of the longest pole that can be put in a room of dimensions (10 m × 10 m × 5m) is

(A) 15 m (B) 16 m (C) 10 m (D) 12 m

QUESTIONS FROM EXEMPLAR

Q1)

A sphere and a right circular cylinder of the same radius have equal volumes. By what percentage does the diameter of the cylinder exceed its height ?

Q2)

A cube of side 4 cm contains a sphere touching its sides. Find the volume of the gap in between.

Q3)

The volumes of the two spheres are in the ratio 64 : 27. Find the ratio of their surface areas.

Q4)

A cylindrical tube opened at both the ends is made of iron sheet which is 2 cm thick. If the outer diameter is 16 cm and its length is 100 cm, find how many cubic centimeters of iron has been used in making the tube ?

Q5)

A semi-circular sheet of metal of diameter 28cm is bent to form an open conical cup. Find the capacity of the cup.

Q6)

A cloth having an area of 165 m^2 is shaped into the form of a conical tent of radius 5 m

(i) How many students can sit in the tent if a student, on an average, occupies $\frac{5}{7}m^2$ on the ground?

(ii) Find the volume of the cone.

Q7)

Find the amount of water displaced by a solid spherical ball of diameter 4.2 cm, when it is completely immersed in water.

Q8)

How many square metres of canvas is required for a conical tent whose height is 3.5 m and the radius of the base is 12 m?

CRITICAL THINKING AND CASE STUDY BASED QUESTIONS

Q1)

A school provides milk to the students daily in a cylindrical glasses of diameter 7 cm. If the glass is filled with milk upto an height of 12 cm, find how many litres of milk is needed to serve 1600 students.

Q2)

A right triangle with sides 6 cm, 8 cm and 10 cm is revolved about the side 8 cm. Find the volume and the curved surface of the solid so formed.

Q3)

A shopkeeper has one spherical laddoo of radius 5cm. With the same amount of material, how many laddoos of radius 2.5 cm can be made?

Q4)

A small village, having a population of 5000, requires 75 litres of water per head per day. The village has got an overhead tank of measurement 40 m × 25 m × 15 m. For how many days will the water of this tank last?

Q5)

Two solid spheres made of the same metal have weights 5920 g and 740 g, respectively. Determine the radius of the larger sphere, if the diameter of the smaller one is 5 cm.

Q6)

Metal spheres, each of radius 2 cm, are packed into a rectangular box of internal dimensions 16 cm × 8 cm × 8 cm. When 16 spheres are packed the box is filled with preservative liquid. Find the volume of this liquid. Give your answer to the nearest integer. [Use $\pi=3.14$]

Q7)

The water for a factory is stored in a hemispherical tank whose internal diameter is 14 m. The tank contains 50 kilolitres of water. Water is pumped into the tank to fill to its capacity. Calculate the volume of water pumped into the tank.

Q8)

30 circular plates, each of radius 14 cm and thickness 3cm are placed one above the another to form a cylindrical solid. Find :

(i) the total surface area

(ii) volume of the cylinder so formed.