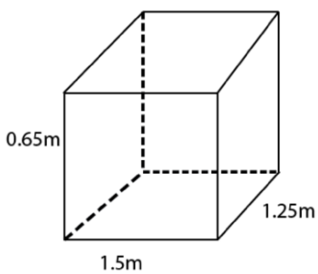
Exercise 13.1 Page No: 213

1. A plastic box 1.5 m long, 1.25 m wide and 65 cm deep, is to be made. It is to be open at the top. Ignoring the thickness of the plastic sheet, determine:
(i) The area of the sheet required for making the box.
(ii) The cost of sheet for it, if a sheet measuring 1 m^2 costs Rs. 20.

Solution:



Given: length (l) of box = 1.5m
Breadth (b) of box = 1.25 m
Depth (h) of box = 0.65m

(i) Box is to be open at top
Area of sheet required.
= 2lh + 2bh + lb
= $[2 \times 1.5 \times 0.65 + 2 \times 1.25 \times 0.65 + 1.5 \times 1.25]m^2$
= $(1.95 + 1.625 + 1.875)m^2 = 5.45\ m^2$

(ii) Cost of sheet per m^2 area = Rs.20.
Cost of sheet of 5.45 m^2 area =Rs (5.45×20)
= Rs.109.

2. The length, breadth and height of a room are 5 m, 4 m and 3 m respectively. Find the cost of white washing the walls of the room and ceiling at the rate of Rs 7.50 per m^2 .
Solution:
Length (l) of room = 5m
Breadth (b) of room = 4m
Height (h) of room = 3m
It can be observed that four walls and the ceiling of the room are to be white washed.
Total area to be white washed = Area of walls + Area of ceiling of room
= 2lh + 2bh + lb
= $[2 \times 5 \times 3 + 2 \times 4 \times 3 + 5 \times 4]$

= (30 + 24 + 20)
= 74
Area = 74 m^2
Also,
Cost of white wash per m^2 area = Rs.7.50 (Given)
Cost of white washing 74 m^2 area = Rs.(74 × 7.50)
= Rs. 555

3. The floor of a rectangular hall has a perimeter 250 m. If the cost of painting 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:
Let length, breadth, and height of the rectangular hall be l, b, and h respectively.
Area of four walls = 2lh + 2 bh
= 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 square meter area = Rs.10
Cost of painting 250h square meter area = Rs (250 h x 10) = Rs.2500h
However, it is given that the cost of paining the walls is Rs. 15000.
15000 = 2500h
Or h = 6
Therefore, the height of the hall is 6 m.

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:

Total surface area of one brick = 2(lb + bh +lb)
= [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
As per given instructions, area that can be painted by the paint of the container = 9.375 m^2 = 93750 cm^2
So we have, 93750 = 937.5n
n = 100
Therefore, 100 bricks can be painted out by the paint of the container.

5. A cubical box has each edge 10 cm and another cuboidal box is 12.5 cm long, 10 cm wide and 8 cm high
(i) Which box has the greater lateral surface area and by how much?
(ii) Which box has the smaller total surface area and by how much?
Solution:
From the question statement, we have
Edge of a cube = 10 cm
Length, l = 12.5 cm
Breadth, b = 10cm
Height, h = 8 cm
(i) Find the lateral surface area for both the figures
Lateral surface area of cubical box = 4 $(\text{edge})^2$
$= 4(10)^2$
$= 400\ cm^2$ …(1)

Lateral surface area of cubodal box = 2[lh + bh]
$= [2(12.5 \times 8 + 10 \times 8)]$
$= (2 \times 180) = 360$
Therefore, Lateral surface area of cubodal box is $360\ cm^2$. …(2)

From (1) and (2), lateral surface area of the cubical box is more than the lateral surface area of the cubodial box. The difference between both the lateral surfaces is, $40\ cm^2$.
(Lateral surface area of cubical box - Lateral surface area of cubodial box=$400cm^2 – 360cm^2 = 40\ cm^2$)
(ii) Find the total surface area for both the figures
The total surface area of the cubical box = $6\ (\text{edge})^2 = 6\ (10\ cm)^2 = 600\ cm^2$ …(3)

Total surface area of cuboidal box
$= 2[lh + bh + lb]$
$= [2(12.5 \times 8 + 10 \times 8 + 12.5 \times 100]$
$= 610$
This implies, Total surface area of cuboidal box is $610\ cm^2$ ..(4)

From (3) and (4), the total surface area of the cubical box is smaller than that of the cuboidal box. And their difference is $10cm^2$.

Therefore, the total surface area of the cubical box is smaller than that of the cuboidal box by $10\ cm^2$

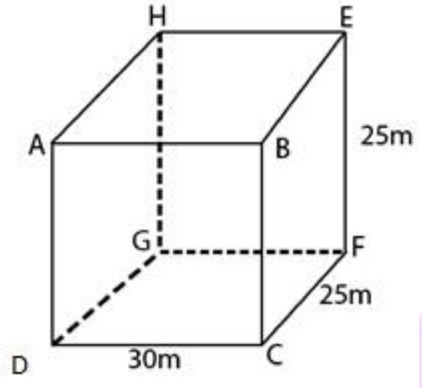
6. A small indoor greenhouse (herbarium) is made entirely of glass panes (including base) held together with tape. It is 30 cm long, 25 cm wide and 25 cm high.
(i) What is the area of the glass?
(ii) How much of tape is needed for all the 12 edges?

Solution:

Length of greenhouse, say l = 30cm
Breadth of greenhouse, say b = 25 cm
Height of greenhouse, say h = 25 cm

(i) Total surface area of greenhouse = Area of the glass = 2[lb + lh + bh]
= [2(30 × 25 + 30 × 25 + 25 × 25)]
= [2(750 + 750 + 625)]
= (2 × 2125) = 4250
Total surface area of the glass is 4250 cm^2

(ii)



From figure, tape is required along sides AB, BC, CD, DA, EF, FG, GH, HE AH, BE, DG, and CF.
Total length of tape = 4(l + b + h)
= [4(30 + 25 + 25)] (after substituting the values)
= 320
Therefore, 320 cm tape is required for all the 12 edges.

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 × 20cm × 5cm and the smaller of dimension 15cm × 12cm × 5cm. 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:
Let l, b and h be the length, breadth and height of the box.
Bigger Box:
l = 25cm
b = 20 cm
h = 5 cm
Total surface area of bigger box = 2(lb + lh + bh)
= [2(25 × 20 + 25 × 5 + 20 × 5)]
= [2(500 + 125 + 100)]
= 1450 cm^2

Extra area required for overlapping 1450 x 5/100 cm2
= 72.5 cm^2
While considering all over laps, total surface area of bigger box
= (1450 + 72.5)cm^2 = 1522.5 cm^2

Area of cardboard sheet required for 250 such bigger boxes
= (1522.5 × 250) cm^2 = 380625 cm^2

Smaller Box:
Similarly, total surface area of smaller box = [2(15 × 12 + 15 × 5 + 12 × 5] cm^2
= [2(180 + 75 + 60)] cm^2
= (2 × 315) cm^2
= 630 cm^2
Therefore, extra area required for overlapping 630 x 5/100 cm2 = 31.5 cm2
Total surface area of 1 smaller box while considering all overlaps
= (630 + 31.5) cm2 = 661.5 cm^2
Area of cardboard sheet required for 250 smaller boxes = (250 × 661.5) cm^2 = 165375 cm^2

In Short:

Box	Dimensions (in cm)	Total surface area (in cm^2)	Extra area required for overlapping (in cm^2)	Total surface area for all overlaps (in cm^2)	Area for 250 such boxes (in cm^2)
Bigger Box	l = 25 b = 20 c = 5	1450	1450 x 5/100 = 72.5	(1450 + 72.5) = 1522.5	(1522.5 × 250) = 380625
Smaller Box	l = 15 b = 12 h =5	630	630 x 5/100 = 31.5	(630 + 31.5) = 661.5	(250 × 661.5) = 165375

Now, Total cardboard sheet required = (380625 + 165375) cm^2
= 546000 cm^2
Given: Cost of 1000 cm^2 cardboard sheet = Rs.4

Therefore, Cost of 546000 cm^2 cardboard sheet = Rs. (546000 x 4)/1000 = Rs. 2184

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

8. Praveen wanted to make a temporary shelter for her car, by making a box – like structure with tarpaulin that covers all the four sides and the top of the car (with the front face as a flap which can be rolled up). Assuming that the stitching margins are very small, and therefore negligible, how much tarpaulin would be required to make the shelter of height 2.5m, with base dimensions 4m × 3m?

Solution:
Let l, b and h be the length, breadth and height of the shelter.
Given:
l = 4m
b = 3m
h = 2.5m
Tarpaulin will be required for the top and four wall sides of the shelter.
Using formula, Area of tarpaulin required = 2(lh + bh)+lb
Put the values of l, b and h, we get
= $[2(4 \times 2.5 + 3 \times 2.5) + 4 \times 3]\ m^2$
= $[2(10 + 7.5) + 12]m^2$
= 47 m^2
Therefore, 47 m^2 tarpaulin will be required

Exercise 13.2 Page No: 216

9. The curved surface area of a right circular cylinder of height 14 cm is 88 cm^2. Find the diameter of the base of the cylinder. (Assume $\pi = 22/7$)

Solution:

Height of cylinder, h = 14cm
Let the diameter of the cylinder be d
Curved surface area of cylinder = 88 cm^2
We know that, formula to find Curved surface area of cylinder is $2\pi rh$.
So $2\pi rh = 88$ cm^2 (r is the radius of the base of the cylinder)
$2\times22/7\times r\times14 = 88$ cm^2
2r = 2 cm
d =2 cm
Therefore, the diameter of the base of the cylinder is 2 cm.

10. It is required to make a closed cylindrical tank of height 1m and base diameter 140 cm from a metal sheet. How many square meters of the sheet are required for the same? Assume π=22/7

Solution:

Let h be the height and r be the radius of a cylindrical tank.

Height of cylindrical tank, h = 1m
Radius = half of diameter = (140/2) cm = 70 cm = 0.7m

Area of sheet required = Total surface are of tank = $2\pi r(r + h)$ unit square
[2 x 22/7 x 0.7 (0.7 + 1)]
= 7.48
Therefore, 7.48 square meters of the sheet are required.

11. A metal pipe is 77 cm long. The inner diameter of a cross section is 4 cm, the outer diameter being 4.4cm. (see fig. 13.11). Find its

Fig. 13.11

(i) inner curved surface area,
(ii) outer curved surface area
(iii) total surface area

(Assume π=22/7)

Solution:
Let r_1 and r_2 Inner and outer radii of cylindrical pipe
r_1 = 4/2 cm = 2cm
r_2 = 4.4/2 cm = 2.2 cm
Height of cylindrical pipe, h = length of cylindrical pipe = 77 cm

(i)curved surface area of outer surface of pipe = 2π r_1 h
= 2 × 22/7 × 2 × 77 cm^2
= 968 cm^2
(ii) curved surface area of outer surface of pipe = 2π r_2 h
= 2 × 22/7 × 2.2 × 77 cm^2
= (22×22×2.2) cm^2
= 1064.8 cm^2

(iii) Total surface area of pipe = **inner curved surface area** + **outer curved surface area** + Area of both circular ends of pipe.

$= 2\pi\, r_1 h + 2\pi\, r_2 h + (r_2^2 - r_1^2)$
$= 9668 + 1064.8 + 2\pi((2.2)^2 - 2^2)$
$= 2031.8 + 5.28$
$2038.08\ cm^2$

Therefore, the total surface area of the cylindrical pipe is 2038.08 cm^2 .

4. The diameter of a roller is 84 cm and its length is 120 cm. It take 500 complete revolutions to move once over to level a playground. Find the area of the playground in m^2? (Assume π=22/7)

Solution:

A roller is shaped like a cylinder.
Let h be the height of the roller and r be the radius.
h = Length of roller = 120 cm
Radius of the circular end of roller = r = (84/2) cm = 42 cm
Now, CSA of roller = 2 πrh
= 2 x 22/7 x 42 x 120
= 31680 cm^2

Area of field = 500 × CSA of roller
= (500 × 31680) cm^2
= 15840000 cm^2
= 1584 m^2 .
Therefore, area of playground is 1584 m^2 . Answer!

5. A cylindrical pillar is 50 cm in diameter and 3.5 m in height. Find the cost of painting the curved surface of the pillar at the rate of Rs. 12.50 per m^2.
(Assume π=22/7)

Solution:
Let h be the height of a cylindrical pillar and r be the radius.
Given:
Height cylindrical pillar = h = 3.5 m
Radius of the circular end of pillar = r = diameter/2 = 50/2 = 25cm = 0.25m
CSA of pillar = 2πrh
= 2×22/7×0.25×3.5
= 5.5 m^2
Cost of painting 1 m^2 area = Rs. 12.50
Cost of painting 5.5 m^2 area = Rs(5.5 ×12.50)
= Rs. 68.75
Therefore, the cost of painting the curved surface of the pillar at the rate of Rs. 12.50 per m^2 is Rs 68.75.

6. Curved surface area of a right circular cylinder is 4.4 m^2. If the radius of the base of the base of the cylinder is 0.7 m, find its height. (Assume π=22/7)

Solution:

Let h be the height of the circular cylinder and r be the radius.
Radius of the base of cylinder, r = 0.7m
CSA of cylinder = 2πrh
CSA of cylinder = 4.4 m^2
Equating both the equations, we have
2 x 22/7 x 0.7 x h = 4.4
Or h = 1
Therefore, the height of the cylinder is 1 m.

7. The inner diameter of a circular well is 3.5 m. It is 10 m deep. Find
(i) its inner curved surface area,
(ii) the cost of plastering this curved surface at the rate of Rs. 40 per m^2.
(Assume π=22/7)

Solution:
Inner radius of circular well, r = 3.5/2m = 1.75m
Depth of circular well, say h = 10m
(i)Inner curved surface area = 2πrh
= (2 x 22/7 x 1.75 x 10)
= 110
Therefore, the inner curved surface area of the circular well is 110 m^2.

(ii)Cost of plastering 1 m^2 area = Rs.40
Cost of plastering 110 m^2 area = Rs (110 x 40)
= Rs.4400
Therefore, the cost of plastering the curved surface of the well is Rs. 4400.

8. In a hot water heating system, there is cylindrical pipe of length 28 m and diameter 5 cm. Find the total radiating surface in the system. (Assume π=22/7)

Solution:
Height of cylindrical pipe = Length of cylindrical pipe = 28 m
Radius of circular end of pipe = diameter/ 2 = 5/2 cm = 2.5 cm = 0.025 m
Now, CSA of cylindrical pipe = 2πrh, where r = radius and h = height of the cylinder
= 2 x 22/7 x 0.025 x 28 m^2
= 4.4 m^2
The area of the radiating surface of the system is 4.4m^2.

9. Find
(i) the lateral or curved surface area of a closed cylindrical petrol storage tank that is 4.2 m in diameter and 4.5m high.
(ii) How much steel was actually used, if 1/12 of the steel actually used was wasted in making the tank. (Assume π=22/7)

Solution:

Height of cylindrical tank, h = 4.5 m
Radius of the circular end , r = (4.2/2)m = 2.1 m
(i) the lateral or curved surface area of cylindrical tank is 2πrh
= 2 x 22/7 x 2.1 x 4.5} m^2
= (44 x 0.3 x 4.5) m^2
= 59.4 m^2
Therefore, CSA of tank is 59.4 m^2.

(ii)Total surface area of tank = $2\pi r(r + h)$
= 2 x 22/7 x (2.1 + 4.5)
= 44 x 0.3 x 6.6
= 87.12 m^2
Now, Let S m^2 steel sheet be actually used in making the tank.
S(1 - 1/12) = 87.12 m^2

This implies, S = 95.04 m^2

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

10. In fig. 13.12, 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. (Assume π=22/7)

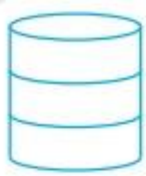


Fig. 13.12

Solution:

Say h = height of the frame of lampshade, looks like cylindrical shape
r = radius
Total height is h = (2.5 + 30 + 2.5) cm = 35 cm and
r = (20/2) cm = 10cm
Use curved surface area formula to find the cloth required for covering the lampshade which is $2\pi rh$
= (2 x 22/7 x 10 x 35) cm^2
= 2200 cm^2
Hence, 2200 cm^2 cloth is required for covering the lampshade.

11. The students of 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? (Assume π=22/7)

Solution:

Radius of the circular end of cylindrical penholder, r = 3cm
Height of penholder, h = 10.5cm
Surface area of a penholder = CSA of penholder + Area of base of penholder
$= 2\pi rh + \pi r^2$
= 2 x 22/7 x 3 x 10.5 + 22/7 x 3^2 = 1584/7
Therefore, Area of cardboard sheet used by one competitor is 1584/7 cm^2

So, Area of cardboard sheet used by 35 competitors = 35 x 1584/7 = 7920 cm^2

Therefore, 7920 cm^2 cardboard sheet will be needed for the competition.

Exercise 13.3 Page No: 221

1. **Diameter of the base of a cone is 10.5 cm and its slant height is 10 cm. Find its curved surface area (Assume π = 22/7)**

Solution:

Radius of the base of cone =diameter/ 2 = (10.5/2) cm = 5.25 cm
Slant height of cone, say l = 10 cm
CSA of cone is = πrl
= (22/7 x 5.25 x 10) = 165
Therefore, the curved surface area of the cone is 165 cm^2.

2. **Find the total surface area of a cone, if its slant height is 21 m and diameter of its base is 24 m. (Assume π = 22/7)**

Solution:

Radius of cone, r = 24/2 m = 12m
Slant height, l = 21 m
Formula: Total Surface area of the cone = $\pi r(l + r)$
Total Surface area of the cone = 22/7 x 12 x (21 + 12) m^2
= 1244.57m^2

3. **Curved surface area of a cone is 308 cm^2 and its slant height is 14 cm. Find**
(i) radius of the base and (ii) total surface area of the cone.
(Assume π=22/7)

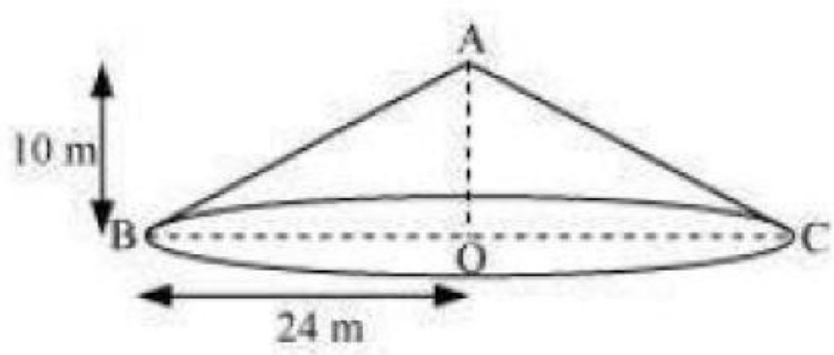
Solution:

Slant height of cone, l = 14 cm
Let the radius of the cone be r.
(i)We know, CSA of cone = πrl
Given: Curved surface area of a cone is 308 cm^2
(308) = (22/7 x r x 14)
308 = 44 r
r = 308/44 = 7
Radius of a cone base is 7 cm.

(ii) Total surface area of cone = CSA of cone + Area of base (πr^2)
Total surface area of cone = 308 + 22/7 x 7^2 = 308 + 154
Therefore, the total surface area of the cone is 462 cm^2.

4. **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 Rs 70.
   (Assume π=22/7)

Solution:



Let ABC be a conical tent
Height of conical tent, h = 10 m
Radius of conical tent, r = 24 m
Let the slant height of the tent be l.

(i)In right triangle, ABO,

$AB^2 = AO^2 + BO^2$ (using Pythagoras theorem)
$l^2 = h^2 + r^2$
$= (10)^2 + (24)^2$
= 676

l = 26
Therefore, the slant height of the tent is 26 m.

(ii) CSA of tent $= \pi rl$
$= (22/7 \times 24 \times 26)\ m^2$
Cost of 1 m^2 canvas = Rs 70
Cost of $(13728/7)m^2$ canvas is equal to Rs $(13728/7) \times 70$ = Rs 137280

Therefore, the cost of the canvas required to make such a tent is Rs 137280.

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

Solution:

Height of conical tent, h = 8 m
Radius of base of tent, r = 6 m
Slant height of tent, $l^2 = (r^2 + h^2)$
$l^2 = (6^2 + 8^2) = (36 + 64) = (100)$
or l = 10

Again, CSA of conical tent $= \pi rl$
$= (3.14 \times 6 \times 10)\ m^2$
$= 188.4\ m^2$

Let the length of tarpaulin sheet required be L
As 20 cm will be wasted, therefore,
Effective length will be (L - 0.2 m).
Breadth of tarpaulin = 3m (given)
Area of sheet = CSA of tent
$[(L - 0.2) \times 3] = 188.4$
$L - 0.2 = 62.8$
L = 63
Therefore, the length of the required tarpaulin sheet will be 63m.

6. The slant height and base diameter of conical tomb are 25 m and 14 m respectively. Find the cost of white-washing its curved surface at the rate of Rs. 210 per 100 m^2. (Assume π = 22/7)

Solution:

Slant height of conical tomb, l = 25m
Base radius, r = diameter/2 = 14/2 m = 7m
CSA of conical tomb = πrl
= 22/7 x 7 x 25 = 550

CSA of conical tomb = $550m^2$
Cost of white-washing 550 m^2 area, which is Rs (210 x 550)/100
= Rs. 1155
Therefore, cost will be Rs. 1155 while white-washing tomb.

6. **A joker's cap is in the form of right circular cone of base radius 7 cm and height 24 cm. Find the area of the sheet required to make 10 such caps. (Assume π=22/7)**

Solution:

Radius of conical cap, r = 7 cm
Height of conical cap, h = 24 cm
Slant height, $l^2 = (r^2 + h^2)$
= $(7^2 + 24^2)$
= (49 + 576)
= (625)
Or l = 25 cm
CSA of 1 conical cap = π r l
= 22/7 x 7 x 24
= 550
CSA of 10 caps = (10 x 550) cm^2 = 5500 cm^2
Therefore, the area of the sheet required to make 10 such caps is 5500 cm^2 .

7. **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 π = 3.14 and take $\sqrt{(1.04)}$ = 1.02)**

Solution:
Given:
Radius of cone, r = diameter/2 = 40/2 cm = 20 cm = 0.2 m
Height of cone, h = 1 m
Slant height of cone is l, and $l^2 = (r^2 + h^2)$
Using given values, $l^2 = (0.2^2 + 1^2)$
= (1.04)
Or l = 1.02
Slant height of the cone is 1.02 m

Now,
CSA of each cone = πrl
= (3.14 x 0.2 x 1.02)
= 0.64056

CSA of 50 such cones = (50 x 0.64056) = 32.028
CSA of 50 such cones = 32.028 m^2
Again,
Cost of painting 1 m^2 area = Rs 12 (given)
Cost of painting 32.028 m^2 area = Rs (32.028 x 12)
= Rs.384.336
= Rs.384.34 (approximately)
Therefore, the cost of painting all these cones is Rs. 384.34.

Exercise 13.4 Page No: 225

1. Find the surface area of a sphere of radius:
(i) 10.5cm (ii) 5.6 cm (iii) 14cm
(Assume π=22/7)

Solution:
Formula: Surface area of sphere (SA) = $4\pi r^2$

(i)Radius of sphere, r = 10.5 cm
SA = 4 x 22/7 x $(10.5)^2$ = 1386
Surface area of sphere is 1386 cm^2
(ii)
Radius of sphere , r = 5.6 cm
Using formula, SA = 4 x 22/ 7 x $(5.6)^2$ = 394.24
Surface area of sphere is 394.24 cm^2
(iii)
Radius of sphere, r = 14 cm
SA = $4\pi r^2$
= 4 x 22/7 x $(14)^2$ = 2464
Surface area of sphere is 2464 cm^2

2. Find the surface area of a sphere of diameter:
(i) 14 cm (ii) 21 cm (iii) 3.5 cm
(Assume π=22/7)

Solution:

Radius of sphere , r = diameter/2 = 14/2 cm = 7 cm

Formula for Surface area of sphere = $4\pi r^2$
= 4 x 22/7 x 7^2 = 616
Surface area of a sphere is 616 cm^2

(ii) Radius (r) of sphere = 21/2 = 10.5 cm
Surface area of sphere = $4\pi r^2$
= 4 x 22/7 x $(10.5)^2$ = 1386
Surface area of a sphere is 1386 cm^2
Therefore, the surface area of a sphere having diameter 21cm is 1386 cm^2

(iii) Radius(r) of sphere= 3.5/2 = 1.75 cm
Surface area of sphere = $4\pi r^2$
= 4 x 22/7 x $(1.75)^2$ = 38.5
Surface area of a sphere is 38.5 cm^2

3. Find the total surface area of a hemisphere of radius 10 cm. [Use π=3.14]
Solution:

Radius of hemisphere, r = 10 cm
Formula: Total surface area of hemisphere = $3\pi r^2$
= 3 x 3.14 x 10^2 = 942
The total surface area of given hemisphere is 942 cm^2

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:

Let $r_1 \, and \, r_2$ be the radii of spherical balloon and spherical balloon when air is pumped into it respectively. So
r_1 = 7 cm
r_2 =14 cm

Now, Required ratio = (initial surface area)/(Surface area after pumping air into balloon)
= $\frac{4\pi r_1^2}{4\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2$

$= (7/14)^2 = (1/2)^2 = ¼$

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

5. A hemispherical bowl made of brass has inner diameter 10.5 cm. Find the cost of tin-plating it on the inside at the rate of Rs 16 per 100 cm^2. (Assume π=22/7)

Solution:

Inner radius of hemispherical bowl, say r = diameter/2 = (10.5)/2 cm = 5.25 cm
Formula for Surface area of hemispherical bowl = $2\pi r^2$
$= 2 \times 22/7 \times (5.25)^2 = 173.25$

Surface area of hemispherical bowl is 173.25 cm^2

Cost of tin-plating 100 cm^2 area = Rs 16
Cost of tin-plating 1 cm^2 area = Rs 16 /100
Cost of tin-plating 173.25 cm^2 area = Rs. (16 x 173.25)/100 = Rs 27.72
Therefore, the cost of tin-plating the inner side of the hemispherical bowl at the rate of Rs 16 per 100 cm^2 is Rs **27.72.**

6. Find the radius of a sphere whose surface area is 154 cm^2. (Assume π=22/7)

Solution:
Let the radius of the sphere be r.
Surface area of sphere = 154 (given)
Now,
$4\pi r^2 = 154$
$r^2 = (154 \times 7)/(4 \times 22) = (49/4)$
$r = (7/2) = 3.5$

The radius of the sphere is 3.5 cm.

7. The diameter of the moon is approximately one fourth of the diameter of the earth. Find the ratio of their surface areas.

Solution:

If diameter of earth is say d, then the diameter of moon will be d/4 (as per given statement)
Radius of earth = d/2
Radius of moon = ½ × d/4 = d/8
Surface area of moon = $4\pi (d/8)^2$
Surface area of earth = $4\pi (d/2)^2$

Ratio of their Surface areas = $\frac{4\pi\left(\frac{d}{8}\right)^2}{4\pi\left(\frac{d}{2}\right)^2}$ = 4/64 = 1/16

The ratio between their surface areas is 1:16.

8. A hemispherical bowl is made of steel, 0.25 cm thick. The inner radius of the bowl is 5cm. Find the outer curved surface of the bowl. (Assume π = 22/7)

Solution:

Given:

Inner radius of hemispherical bowl = 5 cm

Thickness of the bowl = 0.25 cm

Outer radius of hemispherical bowl = (5 + 0.25) cm = 5.25 cm

Formula for outer CSA of hemispherical bowl= $2\pi r^2$, where r is radius of hemisphere

= 2 x 22/7 x $(5.25)^2$ = 173.25

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

9. A right circular cylinder just encloses a sphere of radius r (see fig. 13.22). Find

(i) surface area of the sphere,

(ii) curved surface area of the cylinder,

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

Fig. 13.22

Solution:

(i) Surface area of sphere = $4\pi r^2$, where r is the radius of sphere

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

Radius of cylinder = r

CSA of cylinder formula = $2\pi rh = 2\pi r\,(2r)$ (using value of h)

= $4\pi r^2$

(iii) Ratio between areas = (Surface area of sphere)/CSA of Cylinder)

= $\frac{4\pi r^2}{4\pi r^2} = \frac{1}{1}$

Ratio of the areas obtained in (i) and (ii) is 1:1.

Exercise 13.5 Page No: 228

1. **A matchbox measures 4 cm x 2.5 cm x 1.5 cm.What will be the volume of a packet containing 12 such boxes?**

Solution:

Dimensions of a matchbox (a cuboid) are l x b x h = 4 cm x 2.5 cm x 1.5 cm respectively
Formula to find the volume of matchbox = l x b x h = (4 x 2.5 x 1.5) = 15
Volume of matchbox = 15 cm^3
Now, volume of 12 such matchboxes = (15x 12)cm^3 = 180 cm^3
Therefore, the volume of 12 matchboxes is 180 cm^3.

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= 1000 l)**

Solution:

Dimensions of a cuboidal water tank are: l = 6 m and b = 5 m and h = 4.5 m
Formula to find volume of tank , V = l x b x h
Put the values, we get
V = (6 x 5 x 4.5) = 135
Volume of water tank is 135 m^3
Again,
We are given that, amount of water that 1m^3 volume can hold = 1000 l
Amount of water, 135 m^3 volume hold = (135 x 1000) litres = 135000 litres
Therefore, given cuboidal water tank can hold up to 135000 litres of water.

3. A cuboidal vessel is 10 m long and 8 m wide. How high must it be made to hold 380 cubic metres of a liquid?

Solution:
Given:
Length of cuboidal vessel, l = 10 m
Width of cuboidal vessel , b = 8 m
Volume of cuboidal vessel, V = 380 m^3

Let the height of the given vessel be h.

Formula for Volume of a cuboid, V = l x b x h

Using formula, we have
l x b x h = 380
(10) (8) h = 380
Or h = 4.75
Therefore, the height of the vessels is 4.75 m.

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:

The given pit has its length (l) as 8 m, width (b)as 6 m, and depth (h) as 3 m.
Volume of cuboidal pit = l x b x h = (8 x 6 x 3) = 144 (using formula)
Required Volume is 144 m^3
Now,
Cost of digging per m^3 volume = Rs 30
Cost of digging 144 m^3 volume = Rs(144 x30) = Rs 4320

5. The capacity of a cuboidal tank is 50000 litres of water. Find the breadth of the tank, if its length and depth are respectively 2.5 m and 10 m.

Solution:

Length (l) and depth (h) of tank is 2.5 m and 10 m respectively.
To find: The value of breadth, say b.
Formula to find the volume of a tank = l x b x h
= (2.5 x b x 10) m^3= 25b m^3
Capacity of tank = 25b m^3 , which is equal to 25000b litres
Also, capacity of a cuboidal tank is 50000 litres of water (Given)
Therefore, 25000 b = 50000
This implies, b = 2
Therefore, the breadth of the tank is 2 m.

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

Solution:

Length of the tank = l = 20 m
Breadth of the tank = b = 15 m
Height of the tank = h = 6 m
Total population of a village = 4000
Consumption of the water per head per day = 150 litres

Water consumed by the people in 1 day = (4000× 150) litres = 600000 litres …(1)

Formula to find the capacity of tank, C = l x b x h
Using given data, we have
C = (20 x 15 x 6) m^3 = 1800 m^3
Or C = 1800000 litres

Let water in this tank last for d days.
Water consumed by all people in d days = Capacity of tank (using equation (1))
600000 d = 1800000
d = 3
Therefore, the water of this tank will last for 3 days. **Answer**

7. A godown measures 40 m x 25 m x 15 m. Find the maximum number of wooden crates each measuring 1.5 m x 1.25 m x 0.5 m that can be stored in the godown.

Solution:
From statement, we have
Length of the godown = 40 m
Breadth = 25 m
Height = 15 m
Whereas,
Length of the wooden crate = 1.5 m
Breadth = 1.25 m
Height = 0.5 m
Since godown and wooden crate are in cuboidal shape. Find the volume of each using formula, V = lbh.
Now,
Volume of godown = (40 x 25 x 15) m^3 = 10000 m^3
Volume of a wooden crate = (1.5 x 1.25 x 0.5) m^3 = 0.9375 m^3

Let us consider that, n wooden crates can be stored in the godown, then
Volume of n wooden crates = Volume of godown

0.9375 x n = 10000
Or n = 10000/0.9375 = 10666.66

Hence, the number of wooden crates can be stored in a godown are 10666.

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:

Side of a cube = 12 cm (Given)
Find the volume of cube:
Volume of cube = $(\text{Side})^3 = (12)^3\ cm^3 = 1728\ cm^3$
Surface area of a cube with side 12 cm = $6a^2 = 6(12)^2\ cm^2$ …(1)
Cube is cut into eight small cubes of equal volume, say side of each cube is p.
Volume of a small cube = p^3
Surface area = $6p^2$ …(2)
Volume of each small cube = $(1728/8)\ cm^3 = 216\ cm^3$
Or $(p)^3 = 216\ cm^3$
Or p = 6 cm
Now, Surface areas of the cubes ratios = (Surface area of bigger cube)/ (Surface area of smaller cubes)
From equation (1) and (2), we get
Surface areas of the cubes ratios = $(6a^2)/(6p^2) = a^2/p^2 = 12^2/6^2 = 4$
Therefore, the required ratio is 4 : 1.

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:
Given:
Depth of river, h = 3 m
Width of river, b = 40 m
Rate of water flow = 2 km per hour = 2000 m / 60 min = 100/3 m/min
Now, Volume of water flowed in 1 min = (100/3 x 40 x 3) = 4000 m^3
Therefore, 4000 m^3 water will fall into the sea in a minute.

Exercise 13.6

Page No: 230

1. The circumference of the base of cylindrical vessel is 132 cm and its height is 25 cm. How many litres of water can it hold? ($1000\ cm^3 = 1L$) (Assume $\pi = 22/7$)

Solution:

Circumference of the base of cylindrical vessel = 132 cm
Height of vessel, h = 25 cm
Let r be the radius of the cylindrical vessel.
Step 1: Find the radius of vessel
We know that, circumference of base = $2\pi r$, so
$2\pi r = 132$ (given)
$r = (132 / (2\pi))$
$r = 66 \times 7/22 = 21$
Radius is 21 cm
Step 2: Find the volume of vessel

Formula: Volume of cylindrical vessel = $\pi r^2 h$
$= 22/7 \times 21^2 \times 25$
$= 34650$
Therefore, volume is $34650\ cm^3$

Since **$1000\ cm^3 = 1L$**
So Volume = $34650/1000$ L = 34.65 L

Therefore, vessel can hold 34.65 litres of water.

2. The inner diameter of a cylindrical wooden pipe is 24 cm and its outer diameter is 28 cm. The length of the pipe is 35 cm. Find the mass of the pipe, if $1\ cm^3$ of wood has a mass of 0.6g. (Assume $\pi = 22/7$)

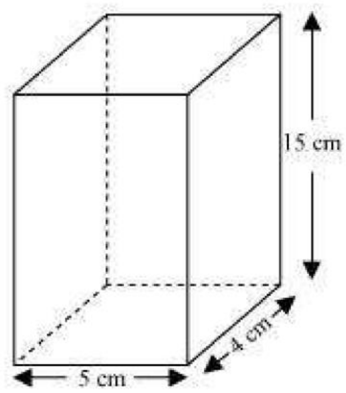
Solution:

Inner radius of cylindrical pipe, say r1 = diameter_1/ 2 = 24/2 cm = 12 cm
Outer radius of cylindrical pipe, say r2 = diameter_2/ 2 = 28/2 cm = 14 cm
Height of pipe, h = Length of pipe = 35 cm
Now, the Volume of pipe = $\pi(r_2^2 - r_1^2)\,h\ \ cm^3$
Substitute the values.
Volume of pipe = $110 \times 52\ cm^3 = 5720\ cm^3$
Since, **Mass of $1\ cm^3$ wood = 0.6 g**
Mass of $5720\ cm^3$ wood = (5720×0.6) g = 3432 g or 3.432 kg. Answer!

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? (Assume π = 22/7)

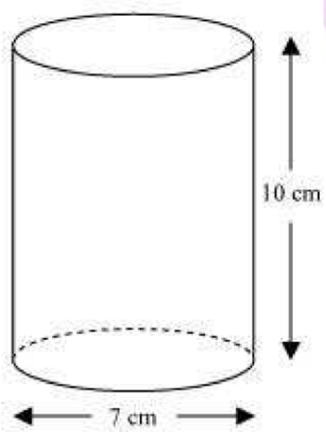
Solution:

(i) tin can will be cuboidal in shape



Dimensions of tin can are
Length, l = 5 cm
Breadth, b = 4 cm
Height, h = 15 cm
Capacity of tin can = l x b x h = (5 x 4 x 15) cm^3 = 300 cm^3

(ii) plastic cylinder will be cylindrical in shape.



Dimensions of plastic can are

Radius of circular end of plastic cylinder, r = 3.5 cm
Height , H =10 cm

Capacity of plastic cylinder = $\pi r^2 H$
Capacity of plastic cylinder = 22/7 x $(3.5)^2$ x 10 = 385
Capacity of plastic cylinder is 385 cm^3

From results of (i) and (ii), plastic cylinder has more capacity.
Difference in capacity = (385 - 300) cm^3 = 85 cm^3

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 π= 3.14]

Solution:
CSA of cylinder = 94.2 cm^2
Height of cylinder, h = 5 cm

(i) Let radius of cylinder be r.
Using CSA of cylinder, we get
$2\pi rh = 94.2$
2 x 3.14 x r x 5 = 94.2
r = 3
Radius is 3 cm

(ii) Volume of cylinder
Formula for volume of cylinder = $\pi r^2 h$
Now, $\pi r^2 h$ = (3.14 x $(3)^2$ x 5) (using value of r from (i))
= 141.3
Volume is 141.3 cm^3

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
(Assume π=22/7)

Solution:

(i) Rs 20 is the cost of painting 1 m^2 area.
Rs 1 is he cost to paint 1/20 m^2 area
So Rs 2200 is the cost of painting = (1/20 x 2200)m^2 =110 m^2 area

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

(ii) Radius of the base of the vessel, let us say r.
Height (h) = 10 m and
Surface area formula = $2\pi rh$
Using result of (i)
$2\pi rh = 110\ m^2$
2 x 22/7 x r x 10 = 110
r= 1.75
Radius is 1.75 m

(iii) Volume of vessel formula = $\pi r^2 h$
Here r = 1.75 and h = 10
Volume = $(22/7 \times (1.75)^2 \times 10) = 96.25$
Volume of vessel is 96.25 m^3
Therefore, the capacity of the vessel is 96.25 m^3 or 96250 litres.

6. The capacity of a closed cylindrical vessel of height 1 m is 15.4 liters. How many square meters of metal sheet would be needed to make it? (Assume π = 22/7)

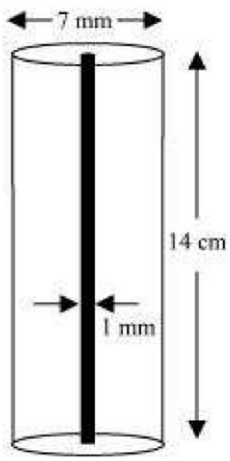
Solution:

Height of cylindrical vessel, h = 1 m
Capacity of cylindrical vessel = 15.4 litres = 0.0154 m^3
Let r be the radius of the circular end.
Now,
Capacity of cylindrical vessel = $(22/7 \times r^2 \times 1) = 0.0154$
After simplifying, we get, r = 0.07 m
Again, total surface area of vessel = $2\pi r (r + h)$
= (2 x 22/7 x 0.07 (0.07 + 1))
= 0.44 · 1.07
= 0.4708
Total surface area of vessel is 0.4708 m^2

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

7. A lead pencil consists of a cylinder of wood with solid cylinder of graphite filled in the interior. The diameter of the pencil is 7 mm and the diameter of the graphite is 1 mm. If the length of the pencil is 14 cm, find the volume of the wood and that of the graphite. (Assume π = 22/7)

Solution:



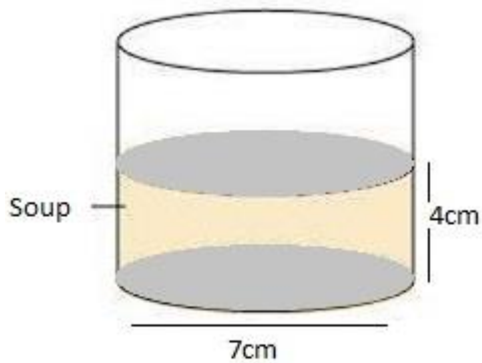
Radius of pencil, $r_1 = \frac{7}{2}\ mm = \frac{0.7}{2} cm = 0.35\ cm$
Radius of graphite, $r_2 = \frac{1}{2}\ mm = \frac{0.1}{2} cm = 0.05\ cm$
Height of pencil, h = 14 cm
Formula to find, volume of wood in pencil = $\pi(r_1^2 - r_2^2)h$ cubic units
Substitute the values, we have
$= \left[\frac{22}{7}(0.35^2 - 0.05^2)14\right]$
= 44 x 0.12
= 5.28
This implies, volume of wood in pencil = 5.28 cm^3

Again,
Volume of graphite = $\pi(r_2^2)h$ cubic units
Substitute the values, we have
$= \left[\frac{22}{7}(0.05)^2 14\right]$
= 44 x 0.0025
= 0.11
So the volume of graphite is 0.11 cm^3.

8. A patient in a hospital is given soup daily in a cylindrical bowl of diameter 7cm. If the bowl is filled with soup to a height of 4cm, how much soup the hospital has to prepare daily to serve 250 patients? (Assume π=22/7)

Solution:

Diameter of cylindrical bowl = 7 cm
Radius of cylindrical bowl, r = 7/2 cm = 3.5 cm
Bowl is filled with soup to a height of 4 cm, so h = 4 cm



Volume of soup in one bowl = $\pi r^2 h$
$(22/7 \times 3.5^2 \times 4) = 154$

Volume of soup in one bowl is 154 cm^3
Volume of soup given to 250 patients = (250 x 154) cm^3 = 38500 cm^3
= 38.5litres. Answer!

Exercise 13.7 Page No: 233

1. Find the volume of the right circular cone with
(i) radius 6 cm, height 7 cm (ii) radius 3.5 cm, height 12 cm (Assume π = 22/7)

Solution:

Volume of cone = (1/3) $\pi r^2 h$ cube units
Where r be radius and h be the height of the cone
(i) Radius of cone, r = 6 cm
Height of cone, h = 7 cm
Say, V be the volume of the cone, we have

$V = \frac{1}{3} \times \frac{22}{7} \times 36 \times 7$
= (12 · 22)
= 264
The volume of the cone is 264 cm^3.

(ii) Radius of cone, r = 3.5 cm
Height of cone, h = 12 cm
Volume of cone = $\frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 7 = 154$

The volume of the cone is 154 cm^3.

2. Find the capacity in litres of a conical vessel with
(i) radius 7 cm, slant height 25 cm (ii) height 12 cm, slant height 12 cm
(Assume π=22/7)

Solution:
(i) Radius of cone, r = 7 cm
Slant height of cone, l = 25 cm

Height of cone, h = $\sqrt{l^2 - r^2}$
h= $\sqrt{25^2 - 7^2}$
h = $\sqrt{625 - 49}$
or h = 24
Height of the cone is 24 cm
Now,
Volume of cone, V = (1/3) $\pi r^2 h$ (formula)

$V = (1/3 \times 22/7 \times 7^2 \times 24)$
$= (154 \cdot 8)$
$= 1232$
So the volume of the vessel is 1232 cm^3

Therefore, capacity of the conical vessel = (1232/1000) liters (because 1L = 1000 cm^3)
= 1.232 Liters.

(ii) Height of cone, h = 12 cm
Slant height of cone, l = 13 cm
Radius of cone, $r = \sqrt{l^2 - h^2}$
$r = \sqrt{13^2 - 12^2}$
$r = \sqrt{169 - 144}$

r = 5
Radius of cone is 5 cm.

Now, Volume of cone, $V = (1/3)\ \pi r^2 h$

$V = (1/3 \times 22/7 \times 52 \times 12)\ cm^3$
= 2200/7
Volume of cone is 2200/7 cm^3

Now,
Capacity of the conical vessel = 2200/7000 litres (1L = 1000 cm^3)
= 11/35 litres

3. The height of a cone is 15 cm. If its volume is 1570 cm^3, find the diameter of its base. (Use π =3.14)

Solution:
Height of the cone, h = 15 cm
Volume of cone =1570 cm^3
Let r be the radius of the cone

As we know: Volume of cone, $V = (1/3)\ \pi r^2 h$
So, $(1/3)\ \pi r^2 h = 1570$
$1/3 \times 3.14 \times r^2 \times 15 = 1570$
$r^2 = 100$
$r = 10$
Radius of the base of cone 10 cm.

4. **If the volume of a right circular cone of height 9 cm is 48 π cm^3, find the diameter of its base.**

Solution:

Height of cone, h = 9 cm
Volume of cone = 48π cm^3
Let r be the radius of the cone.
As we know: Volume of cone, $V = (1/3)\ \pi r^2 h$
So, $1/3\ \pi\ r^2\ (9) = 48\ \pi$
$r^2 = 16$
$r = 4$
Radius of cone is 4 cm.
So diameter = 2 x Radius = 8
Diameter of base is 8 cm.

5. A conical pit of top diameter 3.5 m is 12 m deep. What is its capacity in kiloliters? (Assume π = 22/7)

Solution:
Diameter of conical pit = 3.5
Radius of conical pit, r = diameter/ 2 = (3.5/2) m = 1.75 m
Height of pit, h = Depth of pit = 12 m

Volume of cone, $V = (1/3)\ \pi r^2 h$
$V = 1/3 \times 22/7 \times (1.75)^2 \times 12 = 38.5$
Volume of cone is 38.5 m^3
Hence, capacity of the pit = (38.5 x 1) kiloliters = 38.5 kiloliters.

6. The volume of a right circular cone is 9856 cm^3.If the diameter of the base is 28 cm, find
(i) height of the cone
(ii) slant height of the cone
(iii) curved surface area of the cone
(Assume π=22/7)

Solution:
Volume of a right circular cone = 9856 cm^3
Diameter of the base = 28 cm

(i) Radius of cone, r = (28/2) cm = 14 cm
Let the height of the cone be h
Volume of cone, V = (1/3) $\pi r^2 h$
(1/3) $\pi r^2 h$ = 9856
1/3 x 22/7 x 14 x 14 x h = 9856
h = 48

The height of the cone is 48 cm.

(ii) Slant height of cone, l $= \sqrt{r^2 + h^2}$
l=$\sqrt{14^2 + 48^2}$ = $\sqrt{196 + 2304}$ = 50

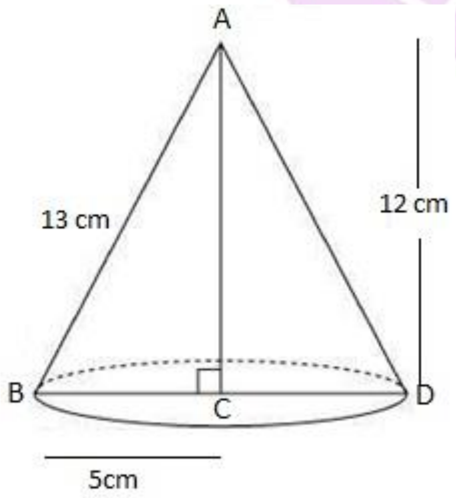
Slant height of the cone is 50 cm.

(iii) curved surface area of cone = π r l
= 22/7 x 14 x 50
= 2200
curved surface area of the cone is 2200 cm^2.

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:

Height (h) = 12 cm
Radius (r) = 5 cm, and
Slant height (l) = 13 cm



Volume of cone, V = (1/3) $\pi r^2 h$

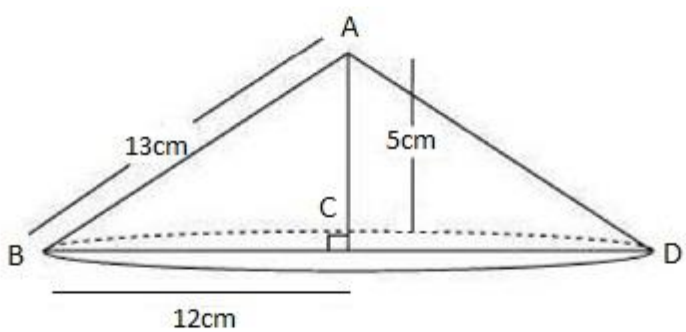
V = (1/3 x π x 5^2 x 12)

= 100π

Volume of the cone so formed is 100π cm^3.

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

Solution:



A right-angled ΔABC is revolved about its side 5 cm, a cone will be formed of radius as 12 cm, height as 5 cm, and slant height as13 cm.

Volume of cone = (1/3) $\pi r^2 h$; where r is the radius and h be the height of cone
= (1/3 x π x 12 x 12 x 5)
= 240 π
The volume of the cones of formed is 240π cm^3.
So, required ratio = (result of question 7) / (result of question 8) = (100π) / (240π) = 5/12 = 5:12.

9. A heap of wheat is in the form of a cone whose diameter is 10.5 m and height is 3 m. Find its volume. The heap is to be covered by canvas to protect it from rain. Find the area of the canvas. (Assume π = 22/7)

Solution:

Radius (r) of heap = (10.5/2) m = 5.25
Height (h) of heap = 3m
Volume of heap = 1/3 $\pi r^2 h$

= 1/3 x 22/7 x 5.25 x 5.25 x 3
= 86.625
The volume of the heap of wheat is 86.625 m^3.
Again,
Area of canvas required = CSA of cone = πrl, where l = $\sqrt{r^2+h^2}$
After substituting the values, we have
CSA of cone = $[\frac{22}{7} \times 5.25 \times \sqrt{(5.25)^2+3^2}]$
= 22/7 x 5.25 x 6.05
= 99.825
Therefore the area of the canvas is 99.825 m^2 .

Exercise 13.8 Page No: 236

1. Find the volume of a sphere whose radius is
(i) 7 cm (ii) 0.63 m
(Assume π=22/7)

Solution:

(i) Radius of sphere, r = 7 cm
Using, Volume of sphere = 4/3 π r^3
= 4/3 x 22/7 x 7^3
= 4312/3
Volume of the sphere is 4312/3 cm^3

(ii) Radius of sphere, r = 0.63 m
Using, vlume of sphere = 4/3 π r^3
= 4/3 x 22/7 x 0.63^3
= 1.0478
Volume of the sphere is 1.05 m^3 (approx).

2. Find the amount of water displaced by a solid spherical ball of diameter
(i) 28 cm (ii) 0.21 m
(Assume π=22/7)

Solution:
(i)
Diameter = 28 cm
Radius, r = 28/2 cm = 14 cm
Volume of the solid spherical ball = 4/3 π r^3
Volume of the ball = 4/3 x 22/7 x 14^3 = 34496/3
Volume of the ball is 34496/3 cm^3

(ii)
Diameter = 0.21 m
Radius of the ball = 0.21/2 m = 0.105 m
Volume of the ball = 4/3 π r^3
Volume of the ball = 4/3 x 22/7 x 0.105^3 m^3
Volume of the ball = 0.004851 m^3

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? (Assume $\pi = 22/7$)

Solution:
diameter of a metallic ball = 4.2 cm
Radius(r) of the metallic ball, r = 4.2/2 cm = 2.1 cm
Volume formula = $4/3\ \pi\ r^3$
Volume of the metallic ball = $4/3 \times 22/7 \times 2.1\ cm^3$
Volume of the metallic ball = $38.808\ cm^3$

Now, using relationship between, density, mass and volume,

Density = Mass/Volume
Mass = Density x volume
= (8.9 x 38.808) g
= 345.3912 g
Mass of the ball is 345.39 g (approx).

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:
Let the diameter of earth be "d". Therefore, the radius of earth will be will be d/2
Diameter of moon will be d/4 and the radius of moon will be d/8

Find the volume of the moon :
Volume of the moon = $4/3\ \pi r^3 = 4/3\ \pi\ (d/8)^3 = 4/3\pi(d^3/512)$

Find the volume of the earth :

Volume of the earth = $4/3\ \pi r^3 = 4/3\ \pi\ (d/2)^3 = 4/3\pi(d^3/8)$

Fraction of the volume of the earth is the volume of the moon

Volume of the moon / volume of the earth = $\frac{\frac{4}{3}\pi(\frac{d^3}{512})}{\frac{4}{3}\pi(\frac{d^3}{8})}$ = 8/512 = 1/64

Answer: Volume of moon is of the 1/64 volume of earth.

5. How many litres of milk can a hemispherical bowl of diameter 10.5 cm hold? (Assume $\pi = 22/7$)

Solution:

Diameter of hemispherical bowl = 10.5 cm
Radius of hemispherical bowl, r = 10.5/2 cm = 5.25 cm
Formula for volume of the hemispherical bowl = $2/3\ \pi\ r^3$
Volume of the hemispherical bowl = $2/3 \times 22/7 \times 5.25^3$ = 303.1875
Volume of the hemispherical bowl is 303.1875 cm^3

Capacity of the bowl = (303.1875)/1000 L = 0.303 litres (approx.)
Therefore, hemispherical bowl can hold 0.303 litres of milk.

6. A hemi spherical 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. (Assume $\pi = 22/7$)

Solution:

Inner Radius of the tank, (r) = 1m
Outer Radius (R) = 1.01m

Volume of the iron used in the tank = $2/3\ \pi(R^3 - r^3)$
Put values,
Volume of the iron used in the hemispherical tank = $2/3 \times 22/7 \times (1.01^3 - 1^3)$ = 0.06348
So volume of the iron used in the hemispherical tank is 0.06348 m^3 .

7. Find the volume of a sphere whose surface area is 154 cm^2 . (Assume $\pi = 22/7$)

Solution:

Let r be the radius of a sphere.
Surface area of sphere = $4\pi r^2$
$4\pi r^2 = 154\ cm^2$ (given)
$r^2 = (154 \times 7)/(4 \times 22)$
r= 7/2
Radius is 7/2 cm
Now,
Volume of the sphere = $4/3\ \pi r^3$
Volume of the sphere = $4/3 \times 22/7 \times (7/2)^3 = 179\ 2/3$
Volume of the sphere is 179 2/3 cm^3

8. A dome of a building is in the form of a hemi sphere. From inside, it was white-washed at the cost of Rs. 4989.60. If the cost of white-washing is Rs 20 per square meter, find the
(i) inside surface area of the dome, (ii) volume of the air inside the dome
(Assume $\pi = 22/7$)

Solution:

(i)Cost of white-washing the dome from inside = Rs 4989.60
Cost of white-washing $1m^2$ area = Rs 20
CSA of the inner side of dome = $498.96/2\ m^2 = 249.48\ m^2$
(ii) Let the inner radius of the hemispherical dome be r.
CSA of inner side of dome = $249.48\ m^2$ (from (i))
Formula to find CSA of a hemi sphere = $2\pi r^2$
$2\pi r^2 = 249.48$
$2 \times 22/7 \times r^2 = 249.48$
$r^2 = (249.48 \times 7) / (2 \times 22)$
$r^2 = 39.69$
$r = 6.3$
Radius is 6.3 m

Volume of air inside the dome =Volume of hemispherical dome
Using formula, volume of the hemisphere = $2/3\ \pi r^3$
$= 2/3 \times 22/7 \times 6.3 \times 6.3 \times 6.3$
$= 523.908$
$= 523.9$ (approx.)
Answer: Volume of air inside the dome is $523.9\ m^3$.

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:

Volume of the solid sphere = $4/3\ \pi r^3$
Volume of twenty seven solid sphere = $27 \times 4/3\ \pi r^3 = 36\ \pi r^3$
(i)
New solid iron sphere radius = r'
Volume of this new sphere = $4/3\ \pi(r')^3$

$4/3\ \pi(r')^3 = 36\ \pi r^3$
$(r')^3 = 27r^3$
$r' = 3r$
Radius of new sphere will be 3r (thrice the radius of original sphere)

ii) Surface area of iron sphere of radius r, S = 4 π r^2
Surface area of iron sphere of radius r' = $4\pi\ (r')^2$
Now
S/S' = $(4\pi r^2)/(4\pi\ (r')^2)$
S/S' = $r^2/(3r)^2 = 1/9$
The ratio of S and S' is 1:9.

10. A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in mm^3) is needed to fill this capsule? (Assume π = 22/7)

Solution:
Diameter of capsule = 3.5 mm
Radius of capsule, say r = diameter/ 2 = (3.5/2) mm = 1.75 mm
Volume of spherical capsule = 4/3 π r^3
Volume of spherical capsule = 4/3 x 22/7 x $(1.75)^3$ = 22.458

Answer: The volume of the spherical capsule is 22.46 mm^3 .

Exercise 13.9 Page No: 236

1. A wooden bookshelf has external dimensions as follows: Height = 110 cm, Depth = 25 cm, Breadth = 85 cm (see fig. 13.31). The thickness of the plank is 5cm everywhere. The external faces are to be polished and the inner faces are to be painted. If the rate of polishing is 20 paise per cm^2 and the rate of painting is 10 paise per cm^2, find the total expenses required for polishing and painting the surface of the bookshelf.

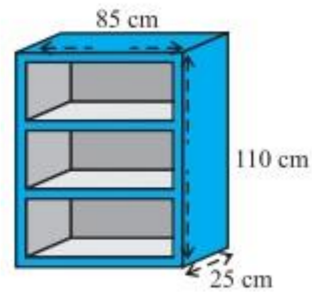


Fig. 13.31

Solution:

External dimensions of book self,
Length, l = 85 cm
Breadth, b = 25 cm
Height, h =110 cm
External surface area of shelf while leaving out the front face of the shelf
= lh + 2 (lb + bh)
= [85 x 110 + 2 (85 x 25 + 25 x 110)] = (9350 + 9750) = 19100
External surface area of shelf is 19100 cm^2

Area of front face = [85x 110 – 75 x 100 + 2(75 x 5)] = 1850 + 750
Area is 2600 cm^2

Area to be polished = (19100 + 2600) cm^2 = 21700 cm^2 .
Cost of polishing 1 cm^2 area = Rs 0.20
Cost of polishing 21700 cm^2 area Rs. (21700 x 0.20) = Rs 4340

Dimensions of row of the book shelf
Length(l) = 75 cm
Breadth (b),= 20 cm and
Height(h) = 30 cm

Area to be painted in one row = 2 (l + h) b + lh = [2 (75 +30) x 20 +75 x 30] = (4200 + 2250)= 6450
Area is 6450 cm^2 .

Area to be painted in 3 rows = (3 x 6450) cm^2 = 19350 cm^2 .
Cost of painting 1 cm^2 area = Rs.0.10
Cost of painting 19350 cm^2 area = Rs (19350 x 0.1) = Rs 1935

Total expense required for polishing and painting = Rs. (4340 + 1935) =Rs. 6275

Answer: The cost for polishing and painting the surface of the book shelf is Rs. 6275.

2. The front compound wall of a house is decorated by wooden spheres of diameter 21 cm, placed on small supports as shown in fig. 13.32. Eight such spheres are used forth is purpose, and are to be painted silver. Each support is a cylinder of radius 1.5 cm and height 7 cm and is to be painted black. Find the cost of paint required if silver paint costs 25 paise per cm^2 and black paint costs 5 paise per cm^2.

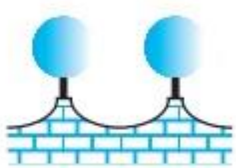


Fig. 13.32

Solution:

Diameter of wooden sphere = 21 cm
Radius of wooden sphere, r = diameter/ 2 = (21/2) cm = 10.5 cm
Formula: Surface area of wooden sphere = $4\pi r^2$
= 4 x 22/7 x $(10.5)^2$ = 1386
Surface area is 1386 cm^3

Radius of the circular end of cylindrical support = 1.5 cm
Height of cylindrical support = 7 cm
Curved surface area = $2\pi rh$
= 2 x 22/7 x 1.5 x 7 = 66
CSA is 66 cm^2
Now,
Area of the circular end of cylindrical support = πr^2
= (22/7 x 1.5^2)
= 7.07
Area of the circular end is 7.07 cm^2
Again,
Area to be painted silver = [8 x (1386 - 7.07)] = 8 x 1378.93 = 11031.44
Area to be painted is 11031.44 cm^2

Cost for painting with silver colour = Rs (11031.44 x 0.25) = Rs 2757.86
Area to be painted black = (8 x 66) cm^2 = 528 cm^2
Cost for painting with black colour = Rs (528 x 0.05) = Rs 26.40

Therefore, the total painting cost is:
= Rs(2757.86 + 26.40)
= Rs 2784.26

Answer!

3. The diameter of a sphere is decreased by 25%. By what percent does its curved surface area decrease?

Solution:

Let the diameter of the sphere be " d".
Radius of sphere, $r_1 = d/2$
New radius of sphere, say $r_2 = \frac{d}{2}\left(1-\frac{25}{100}\right) = \frac{3}{8}d$

Curved surface area of sphere, $(CSA)_1 = 4\pi r_1^2 = 4\pi \cdot (d/2)^2 = \pi d^2$ …(1)
Curved surface area of sphere when radius is decreased $(CSA)_2 = 4\pi r_2^2 = 4\pi \times (3d/8)^2 = (9/16)\pi d^2$ …(2)
From equation (1) and (2), we have
Decrease in surface area of sphere = $(CSA)_1 - (CSA)_2$
= $\pi d^2 - (9/16)\pi d^2$
= $(7/16)\pi d^2$
Percentage decrease in surface area of sphere = $\frac{(CSA)_1-(CSA)_2}{(CSA)_1} \times 100$

$$= \frac{7\pi d^2}{16\pi d^2} \times 100 = \frac{700}{16} = 43.75\%. \mathit{Answer}\,!$$