CHAPTER 13

SURFACE AREAS AND VOLUMES

ONE MARK QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. If the radius of the sphere is increased by 100%, the volume of the corresponding sphere is increased by

(a) 200% (b) 500%

(c) 700% (d) 800%

Ans :

Let r be the original radius of sphere. If we increased radius by 100 %. it will be $2r$.

$$V_r = \frac{4}{3}\pi r^3$$

Now $$V_{2r} = \frac{4}{3}\pi \times (2r)^3 = \frac{4}{3}\pi \times 8r^2$$

Thus new volume is 8 times of original volume.

Hence when the radius is increased by 100%, the corresponding volume becomes 800% and thus increase is 700%.

Thus (c) is correct option.

2. A sphere is melted and half of the melted liquid is used to form 11 identical cubes, whereas the remaining half is used to form 7 identical smaller spheres. The ratio of the side of the cube to the radius of the new small sphere is

(a) $\left(\frac{4}{3}\right)^{1/3}$ (b) $\left(\frac{8}{3}\right)^{1/3}$

(c) $(3)^{1/3}$ (d) 2

Ans :

As per the given conditions,

$$11a^3 = 7 \times \frac{4}{3} \times \frac{22}{7} \times r^3$$

$$\frac{a}{r} = \left(\frac{8}{3}\right)^{1/3}$$

Thus (b) is correct option.

3. The base radii of a cone and a cylinder are equal. If their curved surface areas are also equal, then the ratio of the slant height of the cone to the height of the cylinder is

(a) 2 : 1 (b) 1 : 2

(c) 1 : 3 (d) 3 : 1

Ans :

$$\pi rl = 2\pi rh$$

$$\frac{l}{h} = \frac{2}{1}$$

Thus (a) is correct option.

4. If the perimeter of one face of a cube is 20 cm, then its surface area is

(a) 120 cm^2 (b) 150 cm^2

(c) 125 cm^2 (d) 400 cm^2

Ans :

Edge of cube, $$a = \frac{20}{4}\text{ cm} = 5\text{ cm}$$

Surface area $$6a^2 = 6 \times 5^2\text{ cm}^2 = 150\text{ cm}^2$$

Thus (b) is correct option.

5. Ratio of lateral surface areas of two cylinders with equal height is

(a) 1 : 2 (b) $H : h$

(c) $R : r$ (d) None of these

Ans :

$$2\pi Rh : 2\pi rh = R : r$$

Thus (c) is correct option.

6. Ratio of volumes of two cylinders with equal height is

(a) $H : h$ (b) $R : r$

(c) $R^2 : r^2$ (d) None of these

Ans :

$$\pi R^2 h : \pi r^2 h = R^2 : r^2$$

Thus (c) is correct option.

7. Ratio of volumes of two cones with same radii is

(a) $h_1 : h_2$ (b) $s_1 : s_2$

(c) $r_1 : r_2$ (d) None of these

Ans :

$$\frac{1}{3}\pi r_1^2 h_1 : \frac{1}{3}\pi r_2^2 h_2$$

$$\frac{1}{3}\pi r_1^2 h_1 : \frac{1}{3}\pi r_1^2 h_2$$

$(r_1 = r_2)$

$$h_1 : h_2$$

Thus (a) is correct option.

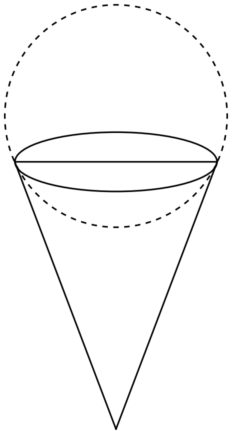
8. The diameter of hollow cone is equal to the diameter of a spherical ball. If the ball is placed at the base of the cone, what portion of the ball will be outside the cone?

(a) 50% (b) less than 50%

(c) more then 50% (d) 100%

Ans :

Though it is given that diameter of the cone is equal to the diameter of the spherical ball. But the ball will not fit into the cone because of its slant shape. Hence more than 50% of the portion of the ball will be outside the cone.



Thus (c) is correct option.

9. Volume of a spherical shell is given by

(a) $4\pi(R^2 - r^2)$ (b) $\pi(R^3 - r^3$

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

Ans :

$$\text{Volume of spherical shell} = \frac{4}{3}\pi R^3 - \frac{4}{3}\pi r^3$$

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

Thus (d) is correct option.

10. The diameter of a sphere is 6 cm. It is melted and drawn into a wire of diameter 2 mm. The length of the wire is

(a) 12 m (b) 18 m

(c) 36 m (d) 66 m

Ans :

Let the length of the wire be l. Since, metallic sphere is converted into a cylindrical shaped wire of length l,

Volume of the metal used in wire is equal to the volume of the sphere.

$$\pi r^2 l = \frac{4}{3}\pi R^3$$

$$\pi \times \left(\frac{2}{2} \times \frac{1}{10}\right)^2 \times l = \frac{4}{3} \times \pi \times \left(\frac{6}{2}\right)^3$$

$$\pi \times \frac{1}{100} \times h = \frac{4}{3} \times \pi \times 3^3$$

$$\frac{l}{100} = 4 \times 3^2 = 36$$

$$l = 3600\text{ cm} = 36\text{ m}$$

Thus (c) is correct option.

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

(a) 2.5 m (b) 3.5 m

(c) 3 m (d) 2 m

Ans : (a) 2.5 m

$$\text{Radius of the well} = \frac{7}{2}\text{m} = 3.5\text{ m}$$

$$\text{Volume of the earth dug out} = \frac{22}{7} \times (3.5)^2 \times 20$$

$$= \frac{22}{7} \times 3.5 \times 3.5 \times 20$$

$$= 770\text{ m}^3$$

$$\text{Area of platform} = (22 \times 14)\text{m}^2$$

$$= 308\text{ m}^2$$

$$\text{Height} = \frac{770}{308} = 2.5\text{ m}$$

12. From a solid circular cylinder with height 10 cm and radius of the base 6 cm, a right circular cone of the same height and same base is removed, then the volume of remaining solid is

(a) $280\,\pi\text{cm}^3$ (b) $330\,\pi\text{cm}^3$

(c) $240\,\pi\text{cm}^3$ (d) $440\,\pi\,\text{cm}^3$

Ans :

Volume of the remaining solid

$$=\text{Volume of the cylinder} - \text{Volume of the cone}$$

$$= \pi \times 6^2 \times 10 - \frac{1}{3} \times \pi \times 6^2 \times 10$$

$$= (360\pi - 120\pi) = 240\pi\text{ cm}^3$$

Thus (c) is correct option.

13. If two solid hemispheres of same base radius r are joined together along their bases, then curved surface area of this new solid is

(a) $4\pi r^2$ (b) $6\pi r^2$

(c) $3\pi r^2$ (d) $8\pi r^2$

Ans :

Because curved surface area of a hemisphere is $2\pi r^2$ and here, we join two solid hemispheres along their bases of radius r, from which we get a solid sphere.

Hence, the curved surface area of new solid $= 2\pi r^2 + 2\pi r^2 = 4\pi r^2$

Thus (a) is correct option.

14. A right circular cylinder of radius r and height h (where, $h > 2r$) just encloses a sphere of diameter

(a) r (b) $2r$

(c) h (d) $2h$

Ans :

Because the sphere encloses in the cylinder, therefore the diameter of sphere is equal to diameter of cylinder which is $2r$.

Thus (b) is correct option.

15. During conversion of a solid from one shape to another, the volume of the new shape will

(a) increase (b) decrease

(c) remain unaltered (d) be doubled

Ans :

During conversion of a solid from one shape to another, the volume of the new shape will remain unaltered.

Thus (c) is correct option.

16. A solid piece of iron in the form of a cuboid of dimensions $49\,\text{cm} \times 33\,\text{cm} \times 24\,\text{cm}$, is moulded to form a solid sphere. The radius of the sphere is

(a) 21 cm (b) 23 cm

(c) 25 cm (d) 19 cm

Ans :

Volume of the sphere = Volume of the cuboid

$$\frac{4}{3}\pi r^3 = 49 \times 33 \times 24 = 38808\,\text{cm}^3$$

$$4 \times \frac{22}{7} r^3 = 38808 \times 3$$

$$r^3 = \frac{38808 \times 3 \times 7}{4 \times 22} = 441 \times 21$$

$$r^3 = 21 \times 21 \times 21$$

$$r = 21\,\text{cm}$$

Thus (a) is correct option.

17. Twelve solid spheres of the same size are made by melting a solid metallic cylinder of base diameter 2 cm and height 16 cm. The diameter of each sphere is

(a) 4 cm (b) 3 cm

(c) 2 cm (d) 6 cm

Ans :

Volume of the twelve solid sphere is equal to the volume of cylinder.

$$V_{12\,\text{sphere}} = V_{\text{cylinder}}$$

$$12 \times \frac{4}{3}\pi r^3 = \pi\left(\frac{2}{1}\right)^2 \times 16$$

$$16\pi r^3 = 16\pi$$

$$r^3 = 1 \Rightarrow r = 1\,\text{cm}$$

Diameter of each sphere, $d = 2r = 2 \times 1 = 2\,\text{cm}$

Thus (c) is correct option.

18. In a right circular cone, the cross-section made by a plane parallel to the base is a

(a) circle (b) frustum of a cone

(c) sphere (d) hemisphere

Ans :

In a right circular cone, if any cut is made parallel to its base, the result would be the base of the cone, which in cross-section is a circle.

Thus (a) is correct option.

19. Volumes of two spheres are in the ratio 64 : 27. The the ratio of their surface areas is

(a) 3 : 4 (b) 4 : 3

(c) 9 : 16 (d) 16 : 9

Ans :

Let the radii of the two spheres are r_1 and r_2, respectively.

Given, ratio of their volumes,

$$V_1 : V_2 = 64 : 27$$

$$\frac{V_1}{V_2} = \frac{64}{27}$$

$$\frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{64}{27}$$

$$\frac{r_1^3}{r_2^3} = \frac{64}{27}$$

$$\frac{r_1}{r_2} = \frac{4}{3}$$

Now, ratio of their surface area,

$$\frac{S_1}{S_2} = \frac{4\pi r_1^2}{4\pi r_2^2} = \frac{r_1^2}{r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

Hence, the required ratio of their surface area is 16 :9.

Thus (d) is correct option.

20. **Assertion :** Total surface area of the cylinder having radius of the base 14 cm and height 30 cm is $3872\,\text{cm}^2$.

Reason : If r be the radius and h be the height of the cylinder, then total surface area $= (2\pi rh + 2\pi r^2)$.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Ans :

Total surface area,

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

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

$$= 2 \times \frac{22}{7} \times 14(30 + 14) = 88(44)$$

$$= 3872\,\text{cm}^2$$

Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Thus (a) is correct option.

21. **Assertion :** The slant height of the frustum of a cone is 5 cm and the difference between the radii of its two circular ends is 4 cm. Then the height of the frustum is 3 cm.

Reason : Slant height of the frustum of the cone is given by $l = \sqrt{(R - r)^2 + h^2}$.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Ans :

We have, $l = 5\,\text{cm},\ R - r = 4\,\text{cm}$

$$5 = \sqrt{(4)^2 + h^2}$$

$$16 + h^2 = 25$$

$$h^2 = 25 - 16 = 9$$

$$h = 3\,\text{cm}$$

Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Thus (a) is correct option.

22. **Assertion :** If the height of a cone is 24 cm and diameter of the base is 14 cm, then the slant height of the cone is 15 cm.

Reason : If r be the radius and h be the slant height of the cone, then slant height $= \sqrt{h^2 + r^2}$.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Ans :

Slant height $l = \sqrt{\left(\frac{14}{2}\right)^2 + (24)^2}$

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

$$= \sqrt{625} = 25$$

Assertion (A) is false but reason (R) is true.

Thus (d) is correct option.

Fill in the Blank Questions

23. The volume of a hemisphere is .... the volume of a cylinder if its height and radius is same as that of the cylinder.

Ans :

two-third

24. If a solid of one shape is converted to another, then the volume of the new solid..........

Ans :

remains same

25. A sharpened pencil is a combination of .... and .... shapes.

Ans :

cylinder, cone

26. If we cut a cone by a plane parallel to its base, we obtain a .... and ....

Ans :

cone, frustum of a cone

27. If the radius of a sphere is halved, its volume becomes .... time the volume of original sphere.

Ans :

one-eighth

28. Surahi is the combination of .... and ....

Ans :

sphere, cylinder

29. The volume of a solid is the measurement of the portion of the .... occupied by it.

Ans :

Space

30. In a right circular cone, the cross-section made by a plane parallel to the base is a ....

Ans :

Circle

31. Total curved surface area of the frustum is ....

Ans :

$\pi(r_1+r_2)l+\pi r_1^2+\pi r_2^2$

32. The TSA, CSA stand for .... and .... respectively.

Ans :

Total surface area, Curved surface area.

33. A shuttle cock used for playing badminton has the shape of the combination of .... of cone and hemisphere.

Ans :

Frustum

34. .... is measured in square units.

Ans :

Area

35. In the gilli-danda game, the shape of a gilli is a combination of two cones and ....

Ans :

Cylinder

36. .... is measured in cubic units.

Ans :

Volume

37. A cube is a special type of ....

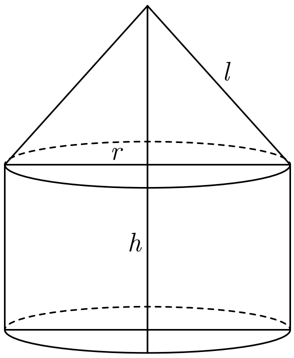
Ans :

Cuboid

38. The total surface area of a solid hemisphere having radius r is ....

$3\pi r^2$

39. The total surface area of the given solid figure is ....



Ans : [Board 2020 SQP Standard]

Given figure is combination of right circular cone and cylinder.

Total surface area

$= $ Area of base of cylinder+

+ Curved surface area of cylinder+

+ Curved surface area of cone

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

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

Very Short Answer Questions

40. A solid metallic cuboid 24 cm × 11 cm × 7 cm is melted and recast and recast into solid cones of base radius 3.5 cm and height 6 cm. Find the number of cones so formed.

Ans :

Let n be the number of cones formed.

Now, according to question,

Volume of n cones = Volume of cuboid

$$n \times \frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 6 = 24 \times 11 \times 7$$

$$n = \frac{24 \times 11 \times 7 \times 3 \times 7}{22 \times 3.5 \times 3.5 \times 6} = 24$$

Thus $n = 24$.

41. The curved surface area of a cylinder is 264 m^2 and its volume is 924 m^3. Find the ratio of its height to its diameter.

Ans : [Board Term-2 2014]

Curved Surface area of cylinder is $2\pi rh$ and volume of cylinder $\pi r^2 h$.

Now $$\frac{\pi r^2 h}{2\pi rh} = \frac{924}{264}$$

$$\frac{r}{2} = \frac{7}{2} \Rightarrow r = 7$$

Substituting $r = 7$ in $2\pi rh = 264$ we have

$$2 \times \frac{22}{7} \times 7 \times h = 264$$

$$h = 6 \text{ m}$$

Now $$\frac{h}{2r} = \frac{6}{14} = \frac{3}{6}$$

Hence, $h : d = 3 : 7$

42. A rectangular sheet paper 40 cm × 22 cm is rolled to form a hollow cylinder of height 40 cm. Find the radius of the cylinder.

Ans : [Board Term-2 Foreign 2014]

Here, $h = 40$ cm, circumference = 22 cm

$$2\pi r = 22$$

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

43. A cylinder, a cone and a hemisphere have same base and same height. Find the ratio of their volumes.

Ans : [Board Term-2 Delhi 2014]

$$V_{cylinder} : V_{cone} : V_{hemisphere} = \pi r^2 h : \frac{1}{3}\pi r^2 h : \frac{2}{3}\pi r^3$$

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

$$= 1 : \frac{1}{3} : \frac{2}{3}$$

$$= 3 : 1 : 2$$

44. What is the ratio of the total surface area of the solid hemisphere to the square of its radius.

Ans : [Board Term-2, 2012]

$$\frac{\text{Total surface area of hemisphere}}{\text{Square of its radius}} = \frac{3\pi r^2}{r^2} = \frac{3\pi}{1}$$

Thus required ratio is $3\pi : 1$.

45. Two cubes each of volume 8 cm^3 are joined end to end, then what is the surface area of resulting cuboid.

Ans : [Board Term-2 2012]

Side of the cube, $a = \sqrt[3]{8} = \sqrt{2}$ cm

Length of cuboid, $l = 4$ cm

Breadth, $b = 2$ cm

Height, $h = 2$ cm

Surface area of cuboid $= 2(l \times b + b \times h + h \times l)$

$$= 2(4 \times 2 + 2 \times 2 + 2 \times 4)$$

$$= 2 \times 20 = 40 \text{ cm}^2$$

46. The radius of sphere is r cm. It is divided into two equal parts. Find the whole surface of two parts.

Ans : [Board Term-2 2012]

Whole surface of each part

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

Total surface of two parts

$$= 2 \times 3\pi r^2 = 6\pi r^2$$

47. What is the volume of a right circular cylinder of base radius 7 cm and height 10 cm ? Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 2012]

We have $r = 7$ cm, $h = 10$ cm,

Volume of cylinder,

$$\pi r^2 h = \frac{22}{7} \times (7)^2 \times 10$$

$$= 1540 \text{ cm}^3$$

48. If the radius of the base of a right circular cylinder is halved, keeping the height same, find the ratio of the volume of the reduced cylinder to that of original cylinder.

Ans : [Board Term-2 2012]

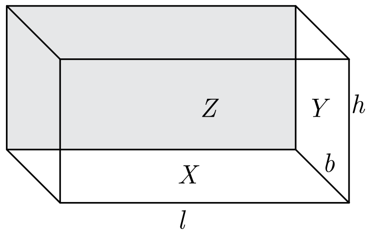
$$\frac{\text{Volume of reduced cylinder}}{\text{Volume of original cylinder}} = \frac{\pi \times \left(\frac{r}{2}\right)^2 h}{\pi r^2 h} = \frac{1}{4}$$

$$= 1 : 4$$

49. If the area of three adjacent faces of a cuboid are X, Y, and Z respectively, then find the volume of cuboid.

Ans : [Board Term-2 2012]

Let the length, breadth and height of the cuboid be l, b and h respectively.



Now $X = l \times b$

$Y = b \times h$

$Z = l \times h$

$XYZ = l^2 \times b^2 \times h^2$

Volume of cuboid,

$$V = lbh = \sqrt{XYZ}$$

50. The radii of two cylinders are in the ratio $2 : 3$ and their heights are in the ratio $5 : 3$, find the ratio of their volumes.

Ans : [Board Term-2 2012]

$$\frac{\text{Volume of 1}^{\text{st}}\text{cylinder}}{\text{Volume of 2}^{\text{nd}}\text{cylinder}} = \frac{\pi r_1^2 h_1}{\pi r_2^2 h_2}$$

$$= \left(\frac{r_1}{r_2}\right)^2 \times \frac{h_1}{h_2}$$

$$= \left(\frac{2}{3}\right)^2 \times \frac{5}{3}$$

$$= \frac{4}{9} \times \frac{5}{3} = \frac{20}{27}$$

$$= 20 : 27$$

51. Volume of two spheres are in the ratio $64 : 27$, find the ratio of their surface areas.

Ans : [Board Term-2 2012]

$$\frac{\text{Volume of I}^{\text{st}}\text{sphere}}{\text{Volume of II}^{\text{nd}}} = \frac{64}{27}$$

$$\frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{64}{27}$$

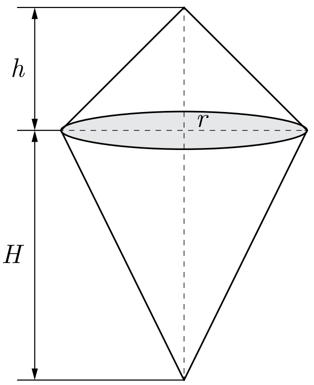
$$\frac{r_1^3}{r_2^3} = \frac{4^3}{3^3}$$

$$\frac{r_1}{r_2} = \frac{4}{3}$$

Ratio of their surface areas,

$$\frac{2\pi r_1^2}{4\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

52. A solid metallic object is shaped like a double cone as shown in figure. Radius of base of both cones is same but their heights are different. If this cone is immersed in water, find the quantity of water it will displace.



Ans : [Board Term-2, 2012]

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

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

Total volume of both the cones $= \frac{1}{3}\pi r^2 h + \frac{1}{3}\pi r^2 H$

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

The quantity of water displaced will be $\frac{1}{3}\pi r^2 (h + H)$ cube units.

53. Find the volume (in cm^3) of the largest right circular cone that can be cut off from a cube of edge 4.2 cm.

Ans : [Board Term-2 2012]

$$\text{Edge of the cube} = 4.2 \text{ cm.}$$

$$\text{Height of the cone} = 4.2 \text{ cm.}$$

$$\text{Radius of the cone} = \frac{4.2}{2} = 2.1 \text{ cm.}$$

Volume of the cone,

$$\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (2.1)^2 \times 4.2$$

$$= 19.4 \text{ cm}^3$$

54. The circumference of the edge of a hemisphere bowl is 132 cm. When π is taken as $\frac{22}{7}$, find the capacity of the bowl in cm^3.

Ans : [Board Term-2 2012]

Let r be the radius of bowl, then circumference of bowl,

$$2\pi r = 132$$

$$r = \frac{132 \times 7}{2 \times 22} = 21 \text{ cm}$$

Capacity i.e volume of the bowl,

$$\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$$

$$= 19404 \text{ cm}^3$$

55. Volume and surface area of a solid hemisphere are numerically equal. What is the diameter of hemisphere ?

Ans : [Board Term-2 Delhi 2017]

Let radius of sphere be r.

Now Volume of sphere = S.A. of hemisphere

$$\frac{2}{3}\pi r^3 = 3\pi r^2$$

$$r = \frac{9}{2} \text{ units}$$

Diameter $d = \frac{9}{2} \times 2 = 9$ units

56. Find the number of solid sphere of diameter 6 cm can be made by melting a solid metallic cylinder of height 45 cm and diameter 4 cm.

Ans : [Board Term-2 Delhi 2014]

Let the number of sphere be n.

Radius of sphere = 3 cm,

Radius of cylinder = 2 cm

Volume of spheres = Volume of cylinder

$$n \times \frac{4}{3}\pi r^3 = \pi r_1^2 h$$

$$n \times \frac{4}{3} \times \frac{22}{7} \times (3)^3 = \frac{22}{7} \times (2)^2 \times 45$$

$$36n = 180$$

$$n = \frac{180}{36} = 5$$

Number of solid sphere is 5.

57. Three solid metallic spherical balls of radii 3 cm, 4 cm and 5 cm are melted into a single spherical ball, find its radius.

Ans : [Board Term-2, 2014]

Let the radius of spherical ball be r.

Volume of spherical ball = Volume of three balls

$$\frac{4}{3}\pi r^3 = \frac{4}{3}\pi[3^3 + 4^3 + 5^3$$

$$r^3 = 27 + 64 + 125 = 216$$

, $$r = 6 \text{ cm}$$

58. 12 solid spheres of the same size are made by melting a solid metallic cone of base radius 1 cm and height of 48 cm. Find the radius of each sphere.

Ans : [Board Term-2, 2014]

No. of spheres $= 12$

Radius of cone, $r = 1$ cm

Height of the cone $= 48$ cm

Volume of 12 spheres = Volume of cone

Let the radius of sphere be R. Let r and h be radius and height of cone.

Now $$12 \times \frac{4}{3}\pi R^3 = \frac{1}{3}\pi r^2 h$$

$$12 \times \frac{4}{3}\pi R^3 = \frac{1}{3}\pi \times (1)^2 \times 48$$

$$R^3 = 1$$

$$R = 1 \text{ cm}$$

59. Three cubes of iron whose edges are 3 cm, 4 cm and 5 cm respectively are melted and formed into a single cube, what will be the edge of the new cube formed ?

Ans : [Board Term-2 Delhi 2012]

Let the edge of single cube be x.

Volume of single cube= Volume of three cubes

$$x^3 = 3^3 + 4^3 + 5^3$$
$$= 27 + 64 + 125 = 216$$
$$x = 6 \text{ cm}$$

60. A solid sphere of radius r melted and recast into the shape of a solid cone of height r. Find the radius of the base of a cone.

Ans : [Board Term-2 Delhi 2012]

Let the radius of cone be R cm.

Volume of sphere = Volume of cone

$$\frac{4}{3}\pi r^3 = \frac{1}{3}\pi R^2 \times r$$
$$4r^3 = R^2 r$$
$$R^2 = 4r^2$$
$$R = 2r$$

61. A cylinder and a cone have base radii 5 cm and 3 cm respectively and their respective heights are 4 cm and 8 cm. Find the ratio of their volumes.

Ans : [Board Term-2 2012]

Volume of cylinder,

$$\pi r^2 h = \pi(5)^2 \times 4 \text{ cm}^3$$
$$= 100\pi \text{ cm}^3$$

Volume of cone,

$$\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 3^2 \times 8$$
$$= 24\pi$$

$$\text{Required ratio} = 100\pi : 24\pi$$
$$= 25 : 6.$$

TWO MARKS QUESTIONS

62. Two cones have their heights in the ratio 1 : 3 and radii in the ratio 3 : 1. What is the ratio of their volumes?

Ans : [Board 2020 Delhi Standard]

Let h_1 and h_2 be height and r_1 and r_2 be radii of two cones.

Now $$\frac{h_1}{h_2} = \frac{1}{3} \text{ and } \frac{r_1}{r_2} = \frac{3}{1}$$

Ratio of their volumes,

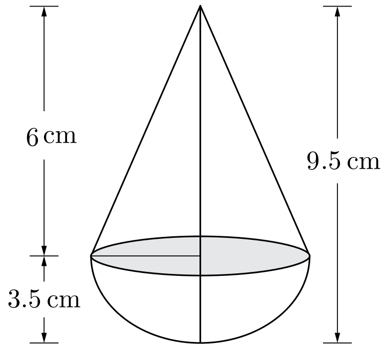
$$\frac{V_1}{V_2} = \frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = \left(\frac{r_1}{r_2}\right)^2\left(\frac{h_1}{h_2}\right) = \left(\frac{3}{1}\right)^2\left(\frac{1}{3}\right) = \frac{3}{1}$$

Hence, ratio of their volumes is 3 :1.

63. A solid is in the shape of a cone surmounted on a hemisphere. The radius of each of them being 3.5 cm and the total height of the solid is 9.5 cm. Find the volume of the solid.

Ans :

As per question the figure is shown below. Here total volume of the toy is equal to the sum of volume of hemisphere and cone.



Volume of toy,

$$\frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3 = \frac{1}{3}\pi r^2(h + 2r)$$
$$= \frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times (6 + 2 \times 3.5)$$
$$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times (6 + 7)$$
$$= \frac{1}{3} \times \frac{22}{2} \times 3.5 \times 13$$
$$= \frac{1}{3} \times 11 \times 3.5 \times 13$$
$$= \frac{500.5}{3} = 166.83 \text{ cm}^3 \quad \text{(Approx)}$$

Hence, the volume of the solid is 166.83 cm^3.

64. Water is flowing at the rate of 15 km/h through a pipe of diameter 14 cm into a cuboidal pond which is 50 m long and 44 m wide. In what time will the level of water in the pond rise by 21 cm?

Ans :

Let t be the time in which the level of the water in the tank will rise by 21 cm.

Length of water that flows in 1 hour is 15 km or 15000 m.

Radius of pipe is $\frac{14}{2} = 7$ cm or 0.07 m.

Volume of water in 1 hour,

$$= \frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 15000$$

$$= 231 \text{ m}^3$$

Volume of water in time t,

$$= 231t \text{ m}^3$$

This volume of water is equal to the water flowed into the cuboidal pond which is 50 m long, 44 m wide and 0.21 m high.

Thus $$231t = 50 \times 44 \times 0.21$$

$$t = \frac{50 \times 44 \times 0.21}{231} = 2 \text{ Hours}$$

65. An open metal bucket is in the shape of a frustum of cone of height 21 cm with radii of its lower and upper ends are 10 cm and 20 cm respectively. Find the cost of milk which can completely fill the bucket at the rate of ₹ 40 per litre.

Ans :

Height of a frustum of a cone,

$$h = 21 \text{ cm}$$

Radius $$r_1 = 10 \text{ cm}$$

and $$r_2 = 20 \text{ cm}$$

Volume of frustum is the capacity of bucket.

Volume of frustum,

$$V = \frac{1}{3}\pi h[r_1^2 + r_2^2 + r_1 r_2]$$

$$= \frac{1}{3} \times \frac{22}{7} \times 21[(10)^2 + (20)^2 + 10 \times 20]$$

$$= 22[100 + 400 + 200]$$

$$= 22 \times 700 = 15400 \text{ cm}^3$$

Quantity of milk,

$$= \frac{15400}{1000} \text{ litres} \qquad (1000 \text{ cm}^3 = 1 \text{ liter})$$

$$= 154 \text{ litres}$$

Total cost of milk $= 15.4 \times$ ₹ 40 = ₹ 616

Hence, the cost of milk which can completely fill the bucket at the rate of ₹ 40 per liter is ₹ 616.

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

Ans :

Radius of conical heap $r = 12$ m

Height of heap, $h = 3.5$ m

Volume of rice,

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 3.5 \text{ m}^3$$

$$= 528 \text{ m}^3$$

Slanted height,

$$l = \sqrt{12^2 + (3.5)^2} = 12.5 \text{ m}$$

Area of canvas cloth required,

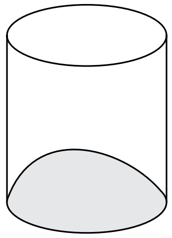
$$\pi r l = \frac{22}{7} \times 12 \times 12.5 = 471.4 \text{ m}^2$$

67. Isha is 10 years old girl. On the result day, Isha and her father Suresh were very happy as she got first position in the class. While coming back to their home, Isha asked for a treat from her father as a reward for her success. They went to a juice shop and asked for two glasses of juice.

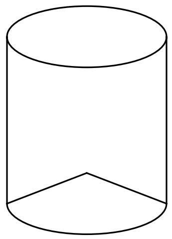
Aisha, a juice seller, was serving juice to her customers in two types of glasses.

Both the glasses had inner radius 3 cm. The height of both the glasses was 10 cm.

First type : A glass with hemispherical raised bottom.



Second type : A glass with conical raised bottom of height 1.5 cm.



Isha insisted to have the juice in first type of glass and her father decided to have the juice in second type of glass. Out of the two, Isha or her father Suresh, who got more quantity of juice to drink and by how much?

Ans :

Let H and h be the height of cylinder and height of cone. Let r be the common radius of cone and cylinder and hemisphere.

Capacity of first glass,

$$= \text{Volume of cylinder} - \text{Volume of hemisphere}$$

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

$$= \pi r^2\left[H - \frac{2}{3}r\right]$$

$$= \pi \times (3)^2\left[10 - \frac{2}{3} \times 3\right]$$

$$= 9\pi \times 8 = 72\pi \text{ cm}^2$$

Capacity of second glass,

$$= \text{Volume of cylinder} - \text{Volume of cone}$$

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

$$= \pi r^2\left[H - \frac{1}{3}h\right]$$

$$= \pi (3)^2\left[10 - \frac{1}{3} \times 15\right]$$

$$= 9\pi \times 9.5 = 85.5\pi \text{ cm}^2$$

Therefore Suresh got more juice of quantity,

$$= 85.5\pi - 72\pi \text{ cm}^2 = 13.5\pi \text{ cm}^3$$

68. A sphere of maximum volume is cut out from a solid hemisphere of radius 6 cm. Find the volume of the cut out sphere.

Ans : [Board Term-2 2012]

Here diameter of sphere is equal to the radius of hemisphere which is 6 cm.

$$\text{Diameter of sphere} = \text{Radius of hemisphere}$$

$$= 6 \text{ cm}$$

$$\text{Radius of sphere} = 3 \text{ cm}$$

$$\text{Volume,} \quad V = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 3^3 \text{ cm}^3.$$

$$= 113.14 \text{ cm}^3.$$

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

Ans : [Board Term-2 2012]

Here diameter of hemisphere is equal to the side of cubical block which is 7 cm.

Diameter of hemisphere = Side of cubical block

$$2r = 7 \Rightarrow r = \frac{7}{2}$$

Surface area of solid

= Surface area of the cube

− Area of base of hemisphere

+ curved surface area of hemisphere

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

$$= 6l^2 + \pi r^2$$

$$= 6 \times 7^2 + \frac{22}{7} \times \left(\frac{7}{2}\right)^2$$

$$= 6 \times 49 + \frac{77}{2} = 332.5 \text{ cm}^2$$

70. A glass cylinder with diameter 20 cm has water to a height of 9 cm. A metal cube of 8 cm edge is immersed in it completely. Calculate the height by which water will rise in the cylinder. Use $\pi = \frac{22}{7}$

OR

A cylinder glass tube with radius 10 cm has water upto a height of 9 cm. A metal cube of 8 cm edge is immersed in it completely. By how much the water will rise in the glass tube. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 2012]

Let h be the height of water raised measured.

Volume of water displaced in cylinder $= \pi(10)^2 h$

Volume of cube,

$$\pi(10)^2 h = 8 \times 8 \times 8$$

$$h = \frac{8 \times 8 \times 8 \times 7}{22 \times 10 \times 10}$$

$$= 1.629 \text{ cm}.$$

71. Two cubes of 5 cm each are kept together joining edge to edge to form a cuboid. Find the surface area of the cuboid so formed.

Ans : [Board Term-2, 2015]

Let l be the length of the cuboid so formed.

Now $l = 5 + 5 = 10$ cm, $b = 5$ cm; $h = 5$ cm.

$$\text{Surface area} = 2(l \times b + b \times h + h \times l)$$
$$= 2(10 \times 5 + 5 \times 5 + 5 \times 10)$$
$$= 2(50 + 25 + 50$$
$$= 2 \times 125$$
$$= 250 \text{ cm}^2.$$

72. If the total surface area of a solid hemisphere is 462 cm^2, find its volume. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 OD 2014]

Total surface area of hemisphere,

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

Volume of hemisphere,

$$\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 7 \times 7 \times 7$$
$$= \frac{2156}{3} = 718.67 \text{ cm}^3.$$

73. A 5 m wide cloth is used to make a conical tent of base diameter 14 m and height 24 m. Find the cost of cloth used at the rate of Rs.25 per meter.

Ans : [Board Term-2 Foreign 2014, Delhi 2014]

We have radius $r = 7$ m and height $h = 24$ m

Slant height of tent,

$$l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2}$$
$$= \sqrt{625} = 25 \text{ m.}$$

Curved surface area of cone,

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

Curves surface area of tent will be required area of cloth. Let x meter of cloth is required

$$5x = 550 \text{ or, } x = \frac{550}{5} = 110 \text{ m.}$$

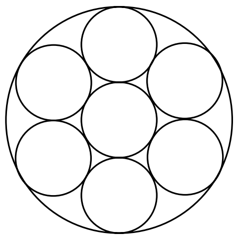
Thus 110 m of cloth is required.

$$\text{Cost of cloth} = 25 \times 110 = Rs.2750.$$

74. Find the number of plates, 1.5 cm in diameter and 0.2 cm thick, that can be fitted completely inside a right circular of height 10 cm and diameter 4.5 cm.

Ans : [Board Term-2 2014]

As per question we can arrange circular plate in right circular as follows. Here smaller circle is plate of 1.5 cm diameter and large circle is cylinder of 4.5 cm diameter.



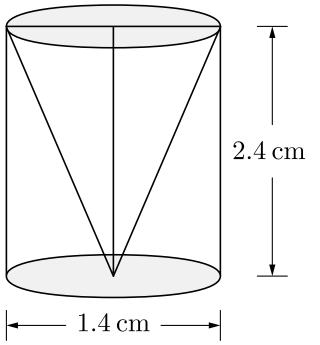
From figure it may be easily seen that 6 plate will be fitted in cylinder in one layer.

Height of six plate is 0.2 cm. Total height of cylinder is 10 cm. Thus layer of plate in cylinder is $\frac{10}{0.2} = 50$ layer. Thus total plate $50 \times 6 = 300$

75. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the volume of the remaining solid to the nearest cm^3. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 2012]

As per question the figure is shown below.



Volume of remaining solid is difference of volume of cylinder and volume of cone.

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

$$= \frac{2}{3} \times \frac{22}{7} \times (0.7)^2 \times 2.4$$

$$= 44 \times 0.1 \times 0.7 \times 0.8$$

$$= 4.4 \times .56 = 2.464 \text{ cm}^3.$$

76. A solid metallic of dimensions 9m $\times$ 8m $\times$ 2 m is melted and recast into solid cubes of edge 2 m. Find the number of cubes so formed.

Ans : [Board Term-2 Foreign 2017]

$$\text{Volume of cuboid} = 9 \times 8 \times 2 \text{ cm}^3$$

$$\text{Volume of cube} = 2^3 \text{ cm}^3$$

Let number of recast cubes be n.

$$\text{Volume of } n \text{ cubes} = \text{Volume of cuboid}$$

$$n2^3 = 9 \times 8 \times 2$$

$$n \times 2 \times 2 \times 2 = 9 \times 8 \times 2$$

$$n = \frac{9 \times 8 \times 2}{2 \times 2 \times 2} = 18$$

Hence, number of cubes recast is 18.

77. A solid metallic cylinder of radius 3.5 cm and height 14 cm melted and recast into a number of small solid metallic ball, each of radius $\frac{7}{12}$ cm. Find the number of balls so formed.

Ans : [Board Term-2 2016]

Let the number of recasted balls be N.

Radius of cylinder $R = 3.5$ cm

Height of cylinder $h = 14$cm

Radius of recasted ball $r = \frac{7}{12}$

$$\text{Volume of balls} = \text{Volume of cylinder}$$

$$n\frac{4}{3}\pi r^3 = \pi R^2 h$$

$$n \times \frac{4}{3} \times \frac{7}{12} \times \frac{7}{12} \times \frac{7}{12} = 3.5 \times 3.5 \times 14$$

$$n = \frac{3.5 \times 3.5 \times 14 \times 3 \times 12 \times 12 \times 12}{4 \times 7 \times 7 \times 7}$$

$$= 0.5 \times 0.5 \times 2 \times 3 \times 3 \times 12 \times 12$$

$$= 648$$

Hence, number of recasted balls is 648.

78. A sphere of diameter 6 cm is dropped in a right circular cylindrical vessel partly filled with water. The diameter of the cylindrical vessel is 12 cm. If the sphere is completely submerged in water, by how much will the level of water rise in the cylindrical vessel ?

Ans : [Board Sample Paper, 2016]

Radius of sphere $\frac{6}{2} = 3$ cm

Radius of cylinder vessel $\frac{12}{2} = 6$ cm

Let the level of water rise in cylinder be h.

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

$$= 4\pi 3^2 = 36\pi \text{ cm}^3$$

$$\text{Volume of sphere} = \text{Increase volume in cylinder}$$

$$36\pi = \pi(6)^2 h$$

$$36\pi = \pi \times 6 \times 6 \times h$$

$$h = 1 \text{ cm}$$

Thus level of water rise in vessel is 1 cm.

79. Find the number of coins of 1.5 cm diameter and 0.2 cm thickness to be melted to form a right circular cylinder of height 10 cm and diameter 4.5 cm.

Ans : [Board Term-2 SQP 2016]

Volume of of any cylinder shape is $\pi r^2 h$.

$$\text{Volume of coin} = \pi(0.75)^2 \times 0.2 \text{ cm}^3$$

$$\text{Volume of cylinder} = \pi(2.25)^2 \times 10 \text{ cm}^3$$

$$\text{No. of coins} = \frac{\text{Volume of cylinder}}{\text{Volume of coin}}$$

$$= \frac{\pi(2.25)^2 \times 10}{\pi(0.75)^2 \times 0.2} = \frac{(3)^2 \times 10}{0.2}$$

$$= 450$$

80. A cone of height 24 cm and radius of base 6 cm is made up of clay. If we reshape it into a sphere, find the radius of sphere.

Ans : [Board Term-2 2014]

$$\text{Volume of sphere} = \text{Volume of cone}$$

$$\frac{4}{3}\pi r_1^3 = \frac{1}{3}\pi r_2^2 h$$

$$\frac{4}{3} \times r_1^3 = (6)^2 \times \frac{24}{3}$$

$$4r_1^3 = 36 \times 24$$

$$r_1^3 = 6^3 \Rightarrow r_1 = 6 \text{ cm}$$

Hence, radius of sphere is 6 cm.

81. A metallic sphere of total volume π is melted and recast into the shape of a right circular cylinder of radius 0.5 cm. What is the height of cylinder ?

Ans : [Board Term-2 2012]

Volume of cylinder = Volume of sphere,

$$\pi r^2 h = \pi$$

where r and h are radius of base and height of cylinder

$$(0.5)^2 h = 1$$

$$0.25h = 1 \Rightarrow h = 4 \text{ cm.}$$

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

Ans : [Board Term-2, 2012]

Volume of sphere = Volume of cylinder

$$\frac{4\pi R^3}{3} = \pi r^2 h$$

$$\frac{4\pi}{3} \times (4.2)^3 = \pi 6^2 \times h$$

$$h = \frac{4 \times 4.2 \times 4.2 \times 4.2}{3 \times 6 \times 6}$$

Hence, height of cylinder is $h = 2.744$ cm.

THREE MARKS QUESTIONS

83. From a solid cylinder whose height is 15 cm and the diameter is 16 cm, a conical cavity of the same height and same diameter is hollowed out, Find the total surface area of remaining solid. (Given your answer in terms of π).

Ans :

Height of cylinder, $h = 15$ cm

Radius of cylinder, $r = \frac{16}{2} = 8\text{ cm}$

Radius of base of cone, $r = 8\text{ cm}$

Let slant height of cone be l, then we have

$$l = \sqrt{r^2 + h^2} = \sqrt{8^2 + 15^2}$$

$$= \sqrt{64 + 225} = \sqrt{289}$$

Thus $l = 17$ cm

TSA of reaming solid

= Top area of cylinder+

+ CSA of cylinder + CSA of conical vanity

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

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

$$= \pi \times 8(3 + 2 \times 15 + 17)$$

$$= \pi \times 8 \times 55 = 440\pi$$

TSA of reaming solid is 440π.

84. The volume of a right circular with its height equal to the radius is $25\frac{1}{7}$ cm^3. Find the height of the cylinder. (Use $\pi = \frac{22}{7}$)

Ans : [Board 2020 OD Standard]

Let r be the radius of base of cylinder and h be height.

Volume of a right circular cylinder $= 25\frac{1}{7}$ cm

$$\pi r^2 h = \frac{176}{7}$$

$$\frac{22}{7} \times h^2 \times h = \frac{176}{7}$$

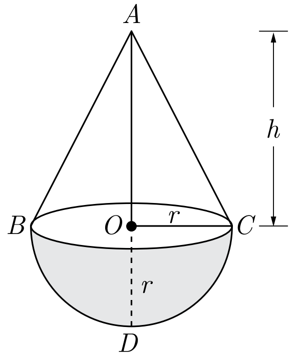
$$h^3 = \frac{176}{22} = 8 = 2^3.$$

Hence, height of the cylinder= 2 cm.

85. A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface areas of the hemispherical part and the conical part are equal, then find the ratio of the radius and the height of the conical part.

Ans : [Board 2020 OD Standard]

Let ABC be a cone, which is mounted on a hemisphere.



We have $OC = OD = r$

Curved surface area of the hemispherical part

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

Slant height of a cone,

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

Curved surface area of a cone $= \pi rl$

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

Since curved surface areas of the hemispherical part and the conical part are equal,

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

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

Squaring both of the sides, we have

$$4r^2 = h^2 + r^2$$

$$4r^2 - r^2 = h^2$$

$$3r^2 = h^2$$

$$\frac{r^2}{h^2} = \frac{1}{3}$$

$$\frac{r}{h} = \frac{1}{\sqrt{3}}$$

Hence, the ratio of the radius and the height is $1:\sqrt{3}$

86. From a solid right circular cylinder of height 14 cm and base radius 6 cm, a right circular cone of same height and same base removed. Find the volume of the remaining solid.

Ans : [Board 2020 OD Standard]

Let h and r be the height and radius of cylinder and cone.

Height, $h = 14$ cm

and radius, $r = 6$ cm

Volume of the remaining solid,

$$V_{remain} = V_{cylinder} - V_{cone}$$

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

$$= \frac{2}{3}\pi r^2 h$$

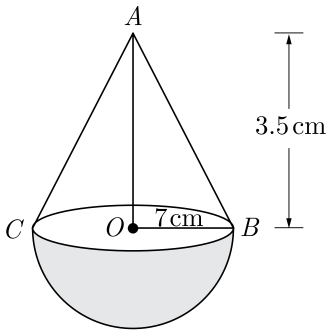
$$= \frac{2}{3} \times \frac{22}{7} \times 6 \times 6 \times 14$$

$$= 1056 \text{ cm}^2$$

87. A solid is in the shape of a hemisphere surmounted by a cone. If the radius of hemisphere and base radius of cone find the volume of the solid. (Take $\pi = \frac{22}{7}$)

Ans : [Board 2020 OD Standard]

As per given information in question we have drawn the figure below,



Here, radius $r = 7$ cm

and height of a cone $= 3.5$ cm

Volume of the solid,

$= $ Volume of hemisphere + volume of a cone

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

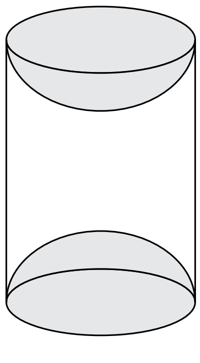
$$= \frac{2}{3} \times \frac{22}{7} \times 7^3 + \frac{1}{3} \times \frac{22}{7} \times 7^3 \times 3.5$$

$$= \frac{1}{3}(2156 + 539)$$

$$= \frac{1}{3} \times 2695$$

$$= 898.33 \text{ cm}^3.$$

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



Ans : [Board 2018]

Total surface Area of article

$= $ CSA of cylinder + CSA of 2 hemispheres

CSA of cylinder $= 2\pi rh$

$$= 2 \times \frac{22}{7} \times 3.5 \times 10$$

$$= 220 \text{ cm}^2$$

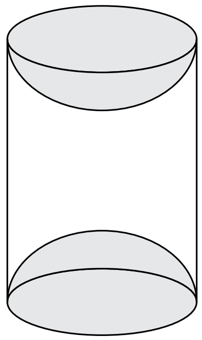
Surface area of two hemispherical scoops

$$= 4 \times \frac{22}{7} \times 3.5 \times 3.5$$

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

Total surface area of article$= 220 + 154 = 374 \text{ cm}^2$

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



Ans : [Board 2018]

Total surface Area of article

$=$ CSA of cylinder + CSA of 2 hemispheres

$$\text{CSA of cylinder} = 2\pi rh$$

$$= 2 \times \frac{22}{7} \times 3.5 \times 10$$

$$= 220 \text{ cm}^2$$

Surface area of two hemispherical scoops

$$= 4 \times \frac{22}{7} \times 3.5 \times 3.5$$

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

Total surface area of article $= 220 + 154 = 374 \text{ cm}^2$

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

Ans : [Board 2020 OD STD, 2019 Delhi]

Canal is the shape of cuboid where

$$\text{Breadth} = 6 \text{ m}$$

$$\text{Depth} = 1.5 \text{ m}$$

and speed of water $= 10 \text{ km/hr}$

Length of water moved in 60 minutes i.e. 1 hour

$$= 10 \text{ km}$$

Length of water moved in 30 minutes i.e. $\frac{1}{2}$ hours,

$$= \frac{1}{2} \times 10 = 5 \text{ km} = 5000 \text{ m}$$

Now, volume of water moved from canal in 30 minutes

$$= \text{Length} \times \text{Breadth} \times \text{Depth}$$

$$= 5000 \times 6 \times 1.5 \text{ m}^3$$

Volume of flowing water in canal

$=$ volume of water in area irrigated

$$5000 \times 6 \times 1.5\text{m}^3 = \text{Area Irrigated} \times 8 \text{ cm}$$

$$5000 \times 6 \times 1.5\text{m}^3 = \text{Area Irrigated} \times \frac{8}{100} \text{ m}$$

$$\text{Area Irrigated} = \frac{5000 \times 6 \times 1.5 \times 100}{8} \text{ m}^2$$

$$= 5.625 \times 10^5 \text{ m}^2$$

91. A right circular cone of radius 3 cm, has a curved surface area of 47.1 cm². Find the volume of the cone. (Use $\pi = 3.14$)

Ans : [Board Term-2 Delhi 2016]

We have $r = 3, \pi rl = 47.1$

Thus $$l = \frac{47.1}{3 \times 3.14} \quad 5$$

$$h = \sqrt{5^2 - 3^2} = 4 \text{ cm}$$

Volume of cone,

$$\frac{1}{3}\pi r^2 h = \frac{1}{3} \times 3.14 \times 3 \times 3 \times 4$$

$$= 37.68 \text{ cm}^3$$

92. The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the solid cylinder is 1628 sq. cm, find the volume of the cylinder. $\pi = \frac{22}{7}$

Ans : [Board Term-2 Delhi 2016]

We have $$r + h = 37 \qquad (1)$$

and $$2\pi r(r + h) = 1628 \qquad (2)$$

Thus $$2\pi r \times 37 = 1628$$

$$2\pi r = \frac{1628}{37} \Rightarrow r = 7 \text{ cm}$$

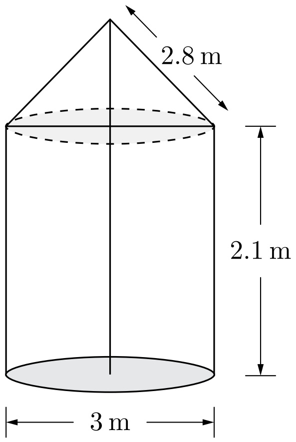
Substituting $r = 7$ in (1) we have

$$h = 30 \text{ cm.}$$

Here volume of cylinder

$$\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 30 = 4620 \text{ cm}^3$$

93. A tent is in the shape of cylinder surmounted by a conical top of same diameter. If the height and diameter of cylindrical part are 2.1 m and 3 m respectively and the slant height of conical part is 2.8 m, find the cost of canvas needed to make the tent if the canvas is available at the rate of Rs.500 per square meter. Use $\pi = \frac{22}{7}$.



Ans : [Board Term-2 OD 2016]

Area of canvas required will be surface area of tent.

Height of cylinder $= 2.1$ m

Radius of cylinder $=$ radius of cone $= \frac{3}{2}$ m

Slant height of cone $= 2.8$ m

Surface area of tent,

$$= C.S.A \text{ of cone} + C.S.A \text{ of cylinder.}$$

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

Thus $$\pi r(l + 2h) = \frac{22}{7} \times \frac{3}{2}(2.8 + 2 \times 2.1)$$

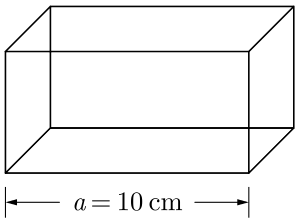
$$= \frac{33}{7} \times 7 = 33 \text{ m}^2$$

Total Cost $= 33 \times 500 = 16,500 Rs$

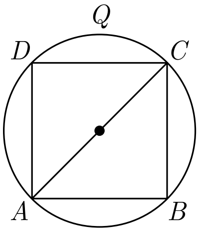
94. A cubical block of side 10 cm is surmounted by a hemisphere. What is the largest diameter that the hemisphere can have ? Find the cost of painting the total surface area of the solid so formed, at the rate of Rs.5 per 100 sq. cm. Use $\pi = 3.14$.

Ans : [Board Term-2 OD 2015]

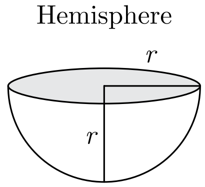
As per question the figure is shown below.



(i)



(ii)



(iii)

Side of given cube $a = 10$ cm

Area of cube(excluding base)

$$A_1 = \text{area of 4 walls + area of Top}$$

$$= 4a^2 + a^2 = 5a^2 = 5(10)^2 = 500 \text{ cm}^2$$

Let r be the largest radius of hemisphere. From fig. (ii) we have

$\square ABCD$, in the square of side 10 cm.

In ΔABC, $\angle B = 90$

From Pythagoras theorem we have

$$AC^2 = AB^2 + BC^2$$

$$(2r)^2 = (10)^2 + (10)^2$$

$$4r^2 = 200 \text{ cm}^2$$

$$r = \sqrt{\frac{200}{4}} = 5\sqrt{2} \text{ cm}$$

Hence, the required diameter of hemisphere

$$d = 2r = 2 \times 5\sqrt{2} = 10\sqrt{2} \text{ cm}$$

Now, area of unshaded part in fig (ii)

$$A_2 = \text{area of circle} - \text{area of square } ABCD$$

$$= \pi r^2 - (a)^2 = [\pi \times 50 - (10)^2]$$

$$= (157 - 100) = 57 \text{ cm}^2$$

Now, Total surface area of solid

$$A = A_1 + A_2 + 2\pi r^2$$

$$= [500 + 57 + 2 \times 3.14 \times 50]$$

$$= 871 \text{ cm}^2$$

The cost of painting of solid

$$= \left(871 \times \frac{5}{100}\right) = 43.55 \text{ Rs}$$

95. A hemispherical bowl of internal diameter 36 cm contains liquid is filled into 72 cylindrical bottles of diameter 6 cm. Find the height of the each bottle, if 10% liquid is wasted in this transfer.

Ans : [Board Term-2 OD 2015]

Volume of the hemispherical bowl of internal diameter 36 cm will be eual to the 72 cylindrical bottles of diameter 6 cm.

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

$$= \frac{2}{3}\pi \times (18)^3 \text{ cm}^3$$

Volume of liquid in bowl is equal to the volume of bowl.

$$\text{Volume of liquid after wastage} = \frac{2}{3}\pi(18)^3 \times \frac{90}{100} \text{ cm}^3$$

Volume of one bottle $= \pi r^2 h$

Volume of liquid in 72 bottles

$$= \pi \times (3)^2 \times h \times 72 \text{ cm}^2$$

Volume of bottles = volume in liquid after wastage

$$\pi \times (3)^2 \times h \times 72 = \frac{2}{3}\pi \times (18)^2 \times \frac{90}{100}$$

$$h = \frac{\frac{2}{3}\pi \times (18)^2 \times \frac{90}{100}}{\pi \times (3)^2 \times 72}$$

Hence, the height of bottle $= 5.4$cm

96. A metallic cylinder has radius 3 cm and height 5 cm. To reduce its weights, a conical hole is drilled in the cylinder. The conical hole has a radius of $\frac{3}{2}$ cm and its depth $\frac{8}{9}$ cm. calculate the ratio of the volume of metal left in the cylinder to the volume of metal taken out in conical shape.

Ans : [Board Term-2 Foreign 2015]

Volume of cylinder,

$$\pi\ ^2 h = \pi(3)^2 \times 5$$

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

Volume of conical hole,

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

$$\text{Metal left in cylinder} = 45\pi - \frac{2}{3}\pi = \frac{133\pi}{3}$$

$$\frac{\text{Volume of metal left}}{\text{Volume of metal taken out}} = \frac{\frac{133}{3}\pi}{\frac{2}{3}\pi} = 133 : 2.$$

Hence required ratio is 133 : 2

97. A solid right-circular cone of height 60 cm and radius 30 cm is dropped in a right-circular cylinder full of water of height 180 cm and radius 60 cm. Find the volume of water left in the cylinder in cubic metre. Use $\pi = \frac{22}{7}$.

Ans : [Board Term-2 Foreign 2015]

Volume of water in cylinder is equal to the volume of cylinder. Thus

Volume of water in cylinder = Volume of cylinder

$$\pi r^2 h = \pi(60)^2 \times 180$$

$$= 648000\pi \text{ cm}^3$$

Water displaced on dropping cone is equal to the volume of solid cone, which is

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

$$= 18000\pi \text{ cm}^3$$

Volume of water left in cylinder

$$= \text{Volume of cylinder} - \text{Volume of cone}$$

$$= 648000\pi - 18000\pi = 630000\pi \text{ cm}^3$$

$$= \frac{630000 \times 22}{1000000 \times 7} \text{ m}^3 = 1.98 \text{ m}^3$$

98. The rain water from 22m $\times$ 20m roof drains into cylindrical vessel of diameter 2 m and height 3.5 m. If the rain water collected from the roof fills $\frac{4th}{5}$ of cylindrical vessel then find the rainfall in cm.

Ans : [Board Term-2 Foreign 2015]

Let h be the rainfall.

Volume of water collected in cylindrical vessel,

$$\frac{4}{5}\pi r^2 h = \frac{4}{5} \times \pi \times (1)^2 \times \left(\frac{7}{2}\right) \text{ m}^3$$

$$= \frac{44}{5} \text{ m}^3$$

Rain water from roof $= 22 \times 20 \times h$ m^3

Now $22 \times 20 \times h = \frac{44}{5}$

$$h = \frac{44}{5} \times \frac{1}{22 \times 20} = \frac{1}{50} \text{ m}^3$$

$$= \frac{1}{50} \times 100 = 2 \text{ cm}$$

99. A hollow cylindrical pipe is made up of copper. It is 21 dm long. The outer and inner diameters of the pipe are 10 cm and 6 cm respectively. Find the volume of copper used in making the pipe.

Ans : [Board Term-2, 2015]

Volume of copper used in making the pipe is equal to the difference of volume of external cylinder and volume of internal cylinder.

Height of cylindrical pipe,

$$h = 21 \text{ dm}$$

$$= 210 \text{ cm}$$

External Radius, $R = \frac{10}{2} = 5$ cm

Internal Radius, $r = \frac{6}{2} = 3$ cm

Volume of copper used in making the pipe

$$= (\text{Volume of External Cylinder})$$

$$- (\text{Volume of Internal Cylinder})$$

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

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

$$= \frac{22}{7} \times 210 \times (5^2 - 3^2)$$

$$= \frac{22}{7} \times 210 \times (25 - 9)$$

$$= \frac{22}{7} \times 210 \times 16$$

$$= 10560 \text{ cm}^3.$$

100. A glass is in the shape of a cylinder of radius 7 cm and height 10 cm. Find the volume of juice in litre required to fill 6 such glasses. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2, 2015]

Radius of the glass $r = 7$ cm

Height of the glass $h = 10$ cm

Volume of 1 glass,

$$\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 10$$

$$= 1540 \text{ cm}^3$$

Volume of juice to fill 6 glasses,

$$6\pi r^2 h = 6 \times 1540 = 9240 \text{ cm}^3$$

$$\text{Volume in litre} = \frac{9240}{1000} = 9.240 \text{ litre.}$$

101. The largest possible sphere is carved out of a wooden solid cube of side 7 cm. Find the volume of the wood left. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2, OD 2014]

The diameter of the largest possible sphere is the side of the cube.

Side of cube $a = 7$ cm

Thus radius of sphere $r = \frac{7}{2}$ cm.

Volume of the wood left,

$$V_{\text{cube}} - V_{\text{sphere}} = a^3 - \frac{4}{3}\pi r^3$$

$$= 7^3 - \frac{4}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3$$

$$= 7^3\left[1 - \frac{4}{3} \times \frac{22}{7} \times \left(\frac{1}{2}\right)^3\right]$$

$$= 7^3\left[1 - \frac{4}{3} \times \frac{22}{7} \times \frac{1}{8}\right]$$

$$= 7^3\left[1 - \frac{11}{21}\right] = 7^3 \times \frac{10}{21} = \frac{490}{3}$$

Hence, volume of wood $= 163.3$ cm^3.

102. A girl empties a cylindrical bucket, full of sand, of radius 18 cm and height 32 cm, on the floor to form a conical heap of sand. If the height of this conical heap is 24 cm, then find its slant height correct upto one place of decimal.

Ans : [Board Term-2 Foreign 2014]

Here volume of cone is equal to the volume of cylinder.

Let r_1 and r_2 be the radii of the cylinder and cone respectively.

$$\text{Volume of cone} = \text{Volume of Cylinder}$$

$$\frac{1}{3}\pi r_2^2 h = \pi r_1 h^2$$

$$\frac{1}{3} \times r_2^2 \times 24 = 18 \times 18 \times 32$$

$$r_2^2 = \frac{3 \times 18 \times 18 \times 32}{24}$$

$$r_2^2 = 1296 \Rightarrow r_2 = 36 \text{ cm}$$

Radius of cone $r_2 = 36$ cm

Now, slant height of cone

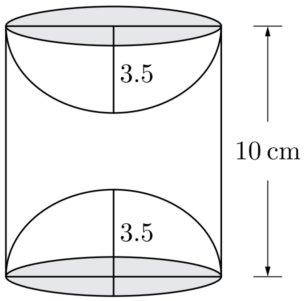
$$l = \sqrt{h^2 + r^2} = \sqrt{24^2 + 36^2}$$

$$= \sqrt{576 + 1296} = 43.2 \text{ cm.}$$

103. A wooden toy was made by scooping out a hemisphere of same radius from each end of a solid cylinder. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the volume of wood in the toy. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 Delhi 2013]

As per question the figure is shown below.



Here radius of toy is equal to the radius of cylinder which is 3.5 cm.

Radius of toy = radius of cylinder = 3.5 cm

Vol. of toy = Vol. of cylinder − 2 × Vol. of hemisphere

$$= \pi r^2 h - 2 \times \frac{2}{3}\pi r^3$$

$$= \pi r^2\left[h - \frac{4r}{3}\right]$$

$$= \frac{22}{7} \times (3.5)^2\left[10 - \frac{4 \times 3.5}{3}\right]$$

$$= \frac{22}{7} \times 3.5 \times 3.5 \times \left[\frac{30 - 4 \times 3.5}{3}\right]$$

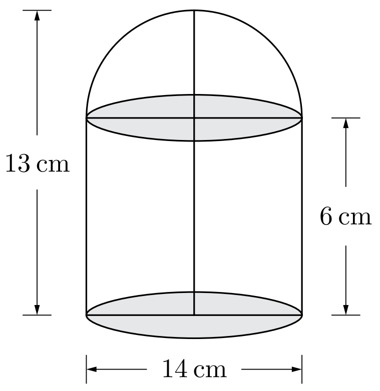
$$= \frac{22}{3} \times 0.5 \times 3.5 \times 16$$

$$= 204.05 \text{ cm}^3.$$

104. A vessel is in the form of a hemispherical bowl surmounted by a hollow cylinder of same diameter. The diameter of the hemispherical bowl is 14 cm and the total height of the vessel is 13 cm. Find the total surface area of the vessel. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 Delhi 2013]

As per question the figure is shown below.



Radius of hemisphere $r = \frac{14}{2} = 7$ cm

Height of cylinder $h = 13 - 7 = 6$ cm

Total slanted area of cylinder,

$$= \text{S.A of hemisphere} + \text{S.A. of cylinder}$$

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

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

$$= \frac{2 \times 22 \times 7}{7} \times (7 + 6)$$

$$= 44 \times 13 = 572 \text{ cm}^2$$

105. The radii of two right circular cylinders are in the ratio of 2 : 3 and their height are in the ratio of 5 : 4. Calculate the ratio of their curved surface area and radio of their volumes.

Ans : [Board Term-2 2012]

Let the radii of two cylinders be $2r$ and $3r$ and their heights be $5h$ and $4h$ respectively.

Ratio of their curved surface areas,

$$= \frac{2\pi \times 2r \times 5h}{2\pi \times 3r \times 4h} = \frac{5}{6}$$

Thus their curved surface areas are in the ratio of 5 : 6.

Ratio of their volumes,

$$= \frac{\pi \times (2r)^2 \times 5h}{2\pi \times 3r \times 4h} = \frac{5 \times 4}{4 \times 9} = \frac{5}{9}$$

Hence, their volumes are in the ratio of 5 : 9 and their $C.SA$ are in the ratio of 5 : 6.

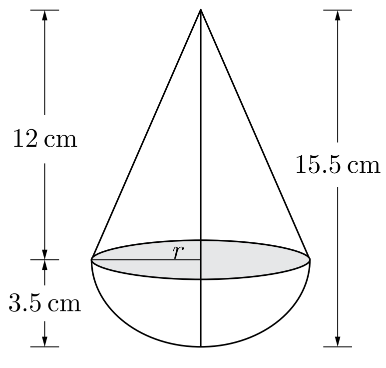
106. A toy is in the form of a cone radius 3.5 cm mounted on a hemisphere of same radius. If the total height of the toy is 15.5 cm, find the total surface area of the toy. Use $\pi = \frac{22}{7}$ [Board OD 2020 Basic]

or

A toy is in the form of a cone surmounted on a hemisphere of common base of diameter 7 cm. If the height of the toy is 15.5 cm, find the total surface area of the toy. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 2012]

As per question the figure is shown below. Here total surface area of the toy is equal to the sum of surface area of hemisphere and curved surface area of cone.



Radius $r = \frac{7}{2} = 3.5$ cm

and height $h = 12$ cm

Slant height of cone,

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

$$= \sqrt{3.5^2 + 12^2} = 12.5$$

Total surface area of the toy

= Surface area of hemisphere +

+ Curved surface area of cone

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

$$= \pi r(2r + l)$$

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

$$= 11 \times 19.5 = 214.5 \text{ cm}^2$$

107. Water is flowing at 7 m/s through a circular pipe of internal diameter of 4 cm into a cylindrical tank, the radius of whose base is 40 cm. Find the increase in water level in 30 minutes.

Ans : [Board Term-2 2012]

Length of water that flows in 1 sec is 7 m or 700 cm.

Radius of pipe is $\frac{4}{2} = 2$ cm.

Thus volume of water in 1 second,

$$= \pi \times (2)^2 \times 700 \text{ cm}^3$$

Volume of water in 30 minutes,

$$= \pi \times (2)^2 \times 700 \times 60 \times 30 \text{ cm}^3$$

Let h be height of water in tank. Radius of tank is 40 cm.

Volume of water in the tank,

$$\pi 40^2 \times h = \pi \times 4 \times 700 \times 60 \times 30$$

$$h = \frac{700 \times 60 \times 30 \times 4}{40 \times 40} = 3150 \text{ cm}$$

Hence, water level increased is 3150 cm or 31.5 m.

108. A metallic solid sphere of radius 10.5 cm melted and recasted into smaller solid cones each of radius 3.5 cm and height 3 cm. How may cones will be made ?

Ans : [Board Term-2 Delhi 2017]

Radius of given sphere $R = 10.5$ cm

Volume of sphere,

$$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi (10.5)^3 \text{ cm}^3$$

Radius of one recasted cone,

$$r = 3.5\text{cm}$$

Height $h = 3$ cm

Volume $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi (3.5)^2 \times 3$

$$= \pi (3.5)^2 \text{ cm}^3$$

Let the number of recasted cones be n. Volume of sphere is equal to the n recasted cone.

$$n\pi (3.5)^2 = \frac{4}{3}\pi (10.5)^3$$

$$n = \frac{4}{3}\frac{(10.5)^3}{(3.5)^2}$$

$$= \frac{4}{3} \times 10.5 \times \left(\frac{10.5}{3.5}\right)^2$$

$$= \frac{4}{3} \times 10.5 \times (3)^3$$

$$= 4 \times 10.5 \times 3 = 126$$

Hence, number of recasted cones is 126.

109. A solid metallic sphere of diameter 16 cm is melted and recasted into smaller solid cones, each of radius 4 cm and height 8 cm. Find the number of cones so formed.

Ans : [Board Term-2 Delhi 2017]

Radius of given sphere $R = \frac{16}{2} = 8$ cm

Volume of sphere,

$$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi (8)^3 \text{ cm}^3$$

Radius of one recasted cone,

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

Height $h = 8$ cm

Volume $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi (4)^2 \times 8$

Let the number of recasted cones be n. Volume of sphere is equal to the n recasted cone.

$$n \times \frac{1}{3}\pi (4)^2 \times 8 = \frac{4}{3}\pi (8)^3$$

$$n = \frac{4 \times (8)^3}{(4)^2 \times 8} = \frac{8^2}{4} = \frac{64}{4} = 16$$

Hence, number of recasted cones is 16.

110. A solid sphere of diameter 6 cm is dropped in a right circular cylindrical vessel partly filled with water. The diameter of the cylindrical vessel is 12 cm. If the sphere is completely submerged into water, by how much will the level of water rise in the cylindrical vessel ?

Ans :

Let h be the rise in level of water.

Radius of sphere $= 3$ cm.

Radius of cylinder $= \frac{12}{2} = 6$ cm

Volume of water displaced in cylinder will be equal to the volume of sphere.

$$\pi (6)^2 h = \frac{4\pi}{3}(3)^3$$

$$6 \times 6 \times h = \frac{4}{3} \times 3 \times 3 \times 3$$

$$6 \times 6 \times h = 4 \times 3 \times 3$$

$$h = \frac{4 \times 3 \times 3}{6 \times 6} = 1 \text{ cm}$$

Hence the water level rises is 1 cm.

111. A conical vessel, with base radius 5 cm height 24 cm, is full of water. This water emptied into a cylindrical vessel, of base radius 10 cm. Find the height to which the water will rise in the cylindrical vessel. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 OD 2016]

Here radius and height of conical vessel are 5 cm and 24 cm.

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

$$= \frac{1}{3}\pi \times 2.5 \times 24$$

When water is emptied into cylindrical vessel, water will rise in cylindrical vessel. Let rise in height be h. Volume of water raised $= \pi r^2 h$. This volume is equal to the volume of cone.

Thus $\pi \times (10)^2 \times h = \frac{1}{3}\pi \times 25 \times 24$

$$100h = 25 \times 8$$

$$h = 2 \text{ cm}$$

112. Water is flowing at the rate of 0.7 m/sec through a circular pipe whose internal diameter is 2 cm into a cylindrical tank, the radius of whose base is 40 cm. Determine the increase in the level of water in half hour.

Ans : [Board Term-2 SQP 2016]

Length of water that flows in 1 sec is 0.7 m or 70 cm.

Radius of pipe is $\frac{2}{2} = 1$ cm.

Volume of water in 1 second,

$$= \pi \times (1)^2 \times 70 = 70\pi \text{cm}^3$$

Volume of water in 30 minutes,

$$= 70\pi \times 60 \times 30 \text{ cm}^3$$

Let h be height of water in tank. Radius of tank is 40 cm.

Volume of water in the tank,

$$\pi 40^2 \times h = 70\pi \times 60 \times 30$$

$$h = \frac{70 \times 60 \times 30}{40 \times 40} = 78.75 \text{ cm}$$

113. A well of diameter 4 m dug 21 m deep. The earth taken out of it has been spread evenly all around it in the shape of a circular ring of width 3 m to form an embankment. Find the height of the embankment.

Ans : [Board Term-2 Delhi 2016]

Radius of earth dug out $r = \frac{4}{2} = 2$ m

Depth of the earth $d = 21,$

Volume of earth $\pi r^2 d = \frac{22}{7} \times (2)^2 \times 21$

$$= 22 \times 4 \times 3 = 264 \text{ m}^2$$

Width of embankment $= 3$ m

Outer radius of ring $= 2 + 3 = 5$ m

Let the height of embankment be h.

Volume of embankment,

$$\pi(R - r)^2 h = 264$$

$$\frac{22}{7} \times (5^2 - 2^2) \times h = 264$$

$$\frac{22}{7} \times (25 - 4) \times h = 264$$

$$\frac{22}{7} \times 21 \times h = 264$$

$$22 \times 3 \times h = 264$$

$$h = \frac{264 \times 7}{22 \times 21} = 4$$

Height of embankment is 4 m.

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

Ans : [Board Term-2 Foreign 2016]

For cylindrical tub,

Radius $R = \frac{12}{2} = 6$ cm

Height $H = 15$ cm.

Volume $\pi R^2 H = \pi(6)^2 \times 15 = 540\pi$ cm^3

Each child will get the ice-cream $\frac{540\pi}{10}$ cm^3

$$= 54\pi \text{ cm}^3$$

For cone, height $h = 2 \times d = 2 \times 2r = 4r$

Volume of cone,

$$\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi r^2 \times 4r = \frac{4}{3}\pi r^3$$

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

Total volume of cone and hemisphere

$$= \frac{4}{3}\pi r^3 + \frac{2}{3}\pi r^3 = \frac{6}{3}\pi r^3 = 2\pi r^3$$

According to question,

$$2\pi r^3 = 54\pi$$

$$r^3 = 27 \Rightarrow r = 3$$

Hence diameter of conical part of ice-cream cones,

$$= 2r = 2 \times 3 = 6 \text{ cm.}$$

115. A hemispherical tank, of diameter 3 m, is full of water. It is being emptied by a pipe at the rate of $3\frac{4}{7}$ litre per second. How much time will it take to make the tank half empty ? Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 Foreign 2016]

Radius $r = \frac{3}{2}$ m

Volume of hemispherical tank,

$$V = \frac{2}{3}\pi r^3 = \frac{2}{3}\pi\left(\frac{3}{2}\right)^3 \text{ m}^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times \frac{27}{8} \text{ m}^3$$

$$= \frac{11}{7} \times \frac{9}{2} = \frac{99}{14} \text{ m}^3$$

Since 1 m^3 = 1000 litre, we have

$$V = \frac{99}{14} \times 1000 \text{ litre}$$

Volume of half of the hemisphere

$$\frac{V}{2} = \frac{1}{2} \times \frac{99}{14} \times 1000 \text{ Litres}$$

Let time taken for this volume to flow out be t. Then according to question,

$$3\frac{4}{7}t = \frac{1}{2} \times \frac{99}{14} \times 1000$$

$$\frac{25t}{7} = \frac{1}{2} \times \frac{99}{14} \times 1000$$

$$t = \frac{7}{25} \times \frac{1}{2} \times \frac{99}{14} \times 1000$$

$$= 990 \text{ sec}$$

$$= 16 \text{ minutes } 30 \text{ sec.}$$

116. 504 cones, each of diameter 3.5 cm and height 3 cm, are melted and recast into a metallic sphere. Find the diameter of the sphere and hence find its surface area. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 Delhi 2015]

Volume of single cone,

$$V_{cone} = \frac{1}{3}\pi r^2 h = \frac{\pi}{3} \times \left(\frac{3.5}{2}\right)^2 \times 3$$

Volume of recast sphere,

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

Volume of sphere is equal to the volume of 504 cones.

Thus $$V_{sphere} = 504\,V_{cone}$$

$$\frac{4\pi}{3} \times r^3 = 504 \times \frac{\pi}{3} \times \left(\frac{3.5}{2}\right)^2 \times 3$$

$$4r^3 = 504 \times \frac{7}{4} \times \frac{7}{4} \times 3$$

$$r^3 = 126 \times \frac{7}{4} \times \frac{7}{4} \times 3$$

$$= 7 \times 9 \times 2 \times \frac{7}{4} \times \frac{7}{4} \times 3$$

$$= 3 \times 3 \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} \times 3$$

$$r = 3 \times \frac{7}{2} = 10.5 \text{ cm}$$

Thus diameter is 21 cm.

Surface area $$4\pi r^2 = 4 \times \frac{22}{7} \times 10.5 \times 10.5$$

$$= 1386 \text{ cm}^2$$

117. A solid metallic cone of radius 2 cm and height 8 cm is melted into a sphere. Find the radius of sphere.

Ans : [Board Term-2 2014]

Let R be the radius of sphere.

Volume of sphere = Volume of cone

$$\frac{4}{3}\pi R^3 = \frac{1}{3}\pi r^2 h$$

$$\frac{4}{3}\pi R^3 = \frac{1}{3}\pi \times (2)^2 \times 8$$

$$4R^3 = 4 \times 8$$

$$R^3 = 8 \Rightarrow R = 2 \text{ cm}$$

118. A sphere of diameter 12 cm, is dropped in a right circular cylindrical vessel, partly filled with water. If the sphere is completely submerged in water, the water level into the cylindrical vessel rises by $3\frac{5}{9}$ cm. Find the diameter of the cylindrical vessel.

Ans : [Board Term-2 OD 2016]

Radius of sphere $$= \frac{12}{2} = 6 \text{ cm}$$

Volume $$= \frac{4}{3}\pi \times 6^3 \text{ cm}^3$$

It is submerged into water, in cylindrical vessel, then water level rise by $3\frac{5}{9} = \frac{32}{9}$ cm. Volume of submerged sphere is equal to the volume of water rise in cylinder.

Volume submerged = Volume rise

Let r be radius of cylinder. Therefore

$$\pi \times r^2 \times \frac{32}{9} = \frac{4}{3}\pi \times 6^3 \text{ cm}$$

$$r^2 = \frac{216 \times 3 \times 4}{32} = \frac{27 \times 3 \times 4}{4}$$

$$r^2 = 27 \times 3 = 81 \Rightarrow r = 9 \text{ cm}$$

Diameter $$2r = 2 \times 9 = 18 \text{ cm.}$$

119. The $\frac{3}{4}$th part of a conical vessel of internal radius 5 cm and height 24 cm is full of water. The water emptied into a cylindrical vessel with internal radius 10 cm. Find the height of water in cylindrical vessel.

Ans : [Board Term-2 Delhi 2017]

Radius of conical vessel $= 5$ cm

Height of conical vessel $= 24$ cm

Volume of this vessel, $= \frac{\pi}{3} \times (5)^2 \times 24$

$= 200\pi \text{ cm}^3$

Internal radius of cylindrical vessel= 10

Let the h be the height of emptied water.

Volume of water in cylinder,

$$\pi r^2 h = \frac{3}{4} \times \text{Volume of cone}$$

$$\pi \times 10 \times 10 \times h = \frac{3}{4} \times 200\pi$$

$$100h = 150 \Rightarrow h = 1.5 \text{ cm}$$

Hence the height of water is 1.5 cm.

120. Rampal decided to donate canvas for 10 tents conical in shape with base diameter 14 m and height 24 m to a centre for handicapped person's welfare. If the cost of 2 m wide canvas is Rs. 40 per meter, find the amount by which Rampal helped the money.

Ans : [Board Term-2 OD Compt. 2017]

Radius of tent $r = \frac{14}{2} = 7$ m

Height $h = 24$ m

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

$= \sqrt{7^2 + 24^2}$

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

Surface area of the tent,

$$\pi r l = \pi r l$$

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

Surface area of 10 tents,

$$= 550 \times 10 = 5500$$

$$\text{Total cost} = 5500 \times \frac{40}{2} = 110000$$

Hence, Rampal helped the centre of 110000 Rs.

121. A cone of maximum size is curved out from a cube edge 14 cm. Find the surface area of remaining solid after the cone is curved out.

Ans : [Board Term-2 SQP 2017]

If a cone of maximum size is curved out from a cube edge a, diameter and height of cone will be a

Side of cube $a = 14$ cm.

If cone of maximum size is curved out,

Radius of cone $r = \frac{14}{2} = 7$ cm

Height of cone $h = 7$ cm

Slant height $l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 14^2}$

$= \sqrt{49 + 196} = \sqrt{245}$

$= 15.65$ cm.

Total surface area,

= Surface area cube + curved Surface area of cone

− Circular area of base of cone

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

$$= 6 \times 14 \times 14 + \frac{22}{7} \times 7 \times 15.65 - \frac{22}{7} \times 7 \times 7$$

$$= 1176 + [22(15.65 - 7)]$$

$$= 1176 \times 22 \times 8.65$$

$$= 223792.8 \text{ cm}^2$$

122. Water in a canal, 5.4 m wide and 1.8 m deep, is flowing with a speed of 25 km/hour. How much area can it irrigate in 40 minutes, if 10 cm of standing water is required for irrigation ?

Ans :

Water flow in 1 hour,

$$= \text{Area of cross-section} \times \text{Speed of water}$$

$$= 5.4 \times 1.8 \times 25000 \text{ m}^3$$

$$= 54 \times 18 \times 250 \text{ m}^3$$

Water flow in 40 minutes,

$$= 54 \times 18 \times 250 \times \frac{40}{60} \text{ m}^3$$

$$= 54 \times 6 \times 500 \text{ m}^3$$

Let A be the irrigated area then volume of water in irrigated area is equal to the water flow.

Thus $A \times 0.1 = 54 \times 6 \times 500$

$$A = 54 \times 6 \times 500 \times 10$$
$$= 1620000 \text{ m}^3$$

123. From a solid cylinder whose height is 8 cm and radius 6 cm, a conical cavity of same height and same base radius is hollowed out. Find the total surface area of the remaining solid. (Take $\pi = 3.14$)

Ans : [Board Term-2 OD Compt. 2017]

Height and radius of cylinder are equal to the height and radius of cone.

$$\text{Height of cylinder} = \text{height of cone} = 8 \text{ cm}$$
$$\text{radius of cylinder} = \text{radius of cone} = 6 \text{ cm}$$
$$\text{Slant height of cone} = \sqrt{r^2 + h^2}$$
$$= \sqrt{6^2 + 8^2} = \sqrt{36 + 64}$$
$$= 10 \text{ cm}$$

Total surface area of remaining solid,

$$= \text{CSA of cylinder} +$$
$$+ \text{CSA of cone} + \text{area of top}$$
$$= 2\pi rh + \pi rl + \pi r^2$$
$$= \pi r(2h + l + r)$$
$$= \frac{22}{7} \times 6(2 \times 8 + 10 + 6)$$
$$= \frac{22}{7} \times 6 \times 32$$
$$= 603.43$$

Hence total surface area is 603.43 cm^{2}.

124. From a solid cylinder of height 24 cm and diameter 14 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid.

Ans : [Board Term-2 Delhi Compt. 2017]

Height and radius of cylinder are equal to the height and radius of cone.

$$\text{Height of cylinder} = \text{height of the cone} = 24 \text{ cm}$$
$$\text{radius of cylinder} = \text{radius of cone} = \frac{14}{2} = 7 \text{ cm}$$
$$\text{Slant height of cone} = \sqrt{r^2 + h^2}$$
$$= \sqrt{7^2 + 24^2}$$
$$= \sqrt{49 + 576} = 25 \text{ cm}$$

Total surface area of remaining part

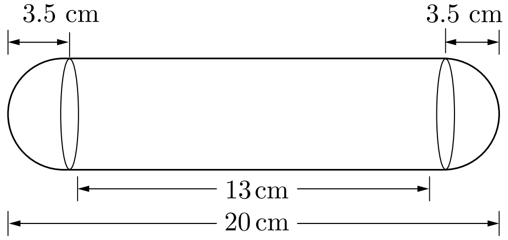
$$= \text{Surface area of cylinder} +$$
$$+ \text{Surface area of cone} + \text{area of top}$$
$$= 2\pi rh + \pi rl + \pi r^2$$
$$= \pi r(2h + l + r)$$
$$= \frac{22}{7} \times 7(2 \times 24 + 25 + 7)$$
$$= 22 \times 80$$
$$= 1760 \text{ cm}^2$$

FOUR MARKS QUESTIONS

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

Ans : [Board 2019 OD]

As per given information in question we have drawn the figure given below.



Height of the cylinder,

$$h = (20 - 7) \text{ cm} = 13 \text{ cm}$$

Radius of circular part,

$$r = \frac{7}{2} \text{ cm}$$

Volume of solid,

$$= \text{Volume of cylinder} + 2 \times \text{Volume of hemisphere}$$
$$V = \pi r^2 h + 2 \times \left(\frac{2\pi}{3} r^3\right)$$
$$= \pi r^2\left(h + \frac{4}{3} r\right)$$

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

$$= \frac{77}{2}\left(\frac{53}{3}\right)\text{cm}^3$$

$$= 680.2\,\text{cm}^3$$

126. The weight of two spheres of same metal are 1 kg and 7 kg. The radius of the smaller sphere is 3 cm. The two spheres are melted to form a single big sphere. Find the diameter of the new sphere.

Ans : [Board 2019 OD Standard]

Weight of smaller sphere, $W_1 = 1\,\text{kg}$

Weight of larger sphere, $W_2 = 7\,\text{kg}$

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

Volume of smaller sphere, $V_1 = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(3)^3$

$$= \frac{4}{3}\pi(27) = 36\pi\,\text{cm}^3$$

Now weight of recanted metal sphere

$$= (1+7)\,\text{kg} = 8\,\text{kg}$$

Since, 1 kg metal sphere occupies $36\pi\,\text{cm}^3$ space.
Thus 8 kg metal sphere occupies $8 \times 36\pi\,\text{cm}^3$ space.
Let R be the radius of new sphere, then volume of new 8 kg sphere is $\frac{4}{3}\pi R^3$.

Thus $\frac{4}{3}\pi R^3 = 36 \times 8\pi\,\text{cm}^3$

$$R^3 = 36 \times 2 \times 3$$

$$R^3 = 9 \times 4 \times 2 \times 3 = 3^3 \times 2^3$$

$$R = 2 \times 3 = 6\,\text{cm}$$

Diameter of new sphere

$$2R = 2 \times 6 = 12\,\text{cm}$$

127. A right cylindrical container of radius 6 cm and height 15 cm if full of ice-cream, which has to be distributed to 10 children in equal cones having hemispherical shape on the top. If the height of the conical portion is four times its base radius, find the radius of the ice-cream cone.

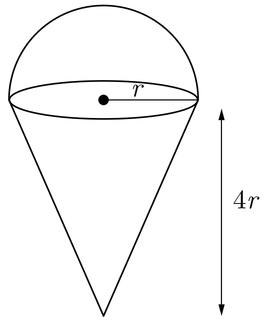
Ans : [Board 2019 OD Standard]

For cylindrical container $R = 6\,\text{cm}$ and $H = 15\,\text{cm}$.

Volume of ice cream in the cylindrical container

$$\pi R^2 H = \pi(6)^2 \times 15 = 36 \times 15\pi$$

As per given information in question we have drawn the figure of cone as given below. Here r is the common radius of cone and hemisphere.



Volume of each cone with hemispherical top

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

$$= \frac{1}{3}\pi r^2(4r+2r)$$

$$= 2\pi r^3$$

Now, volume of ice-cream in container is equal to 10 cone of ice-cream.

$$36 \times 15\pi = 10 \times 2\pi x^3$$

$$r^3 = \frac{36 \times 15}{20} = 27$$

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

128. Hence, radius of the ice-cream cone is 3 cm A well of diameter 4 m is dug 14 m deep. The earth taken out is spread evenly all around the well to form a 40 m high embankment. Find the width of the embankment.

Ans : [Board Term-2 2012]

Depth of well, $d = 14$ m,

Radius, $r = 12$ m.

Volume of earth taken out,

$$\pi r^2 h = \frac{22}{7} \times (2)^2 \times 14$$

$$= \frac{22}{7} \times 2 \times 2 \times 14$$

$$= 176\,\text{m}^3$$

Let r be the width of embankment. The radius of outer circle of embankment

$$= 2 + r$$

Area of upper surface of embankment

$$= \pi\left[(2+r)^2 - (2)^2\right]$$

Volume of embankment= Volume of earth taken out

$$\pi\left[(2+r)^2-(2)^2\right]\times 0.4 = 176$$

$$\pi[4+r^2+4r-4]\times 0.4 = 176$$

$$\frac{0.4\times 22}{7}(r^2+4r) = 176$$

$$r^2+4r = \frac{176\times 7}{0.4\times 22} = 140$$

$$r^2+4r-140 = 0$$

$$(r+14)(r-10) = 0 \Rightarrow r = 10$$

Hence width of embankment is 10 m.

129. A hemispherical depression is cut from one face of a cubical block, such that diameter l of hemisphere is equal to the edge of cube. find the surface area of the remaining solid.

Ans : [Board Term-2 2014]

Let r be the radius of hemisphere.

Now $r = \frac{l}{2}$

Now, the required surface area

= Surface area of cubical block +

− Area of base of hemisphere +

+ Curved surface area of hemisphere.

$$= 6(l)^2-\pi r^2+2\pi r^2$$

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

$$= l^2\left(6-\frac{\pi}{4}+\frac{2\pi}{4}\right)$$

$$= l^2\left(6+\frac{\pi}{4}\right)$$

$$= l^2\left(6+\frac{22}{7\times 4}\right)$$

$$= l^2\left(6+\frac{11}{14}\right) = \frac{95l^2}{14}$$

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

Ans : [Board Term-2 2012, Delhi 2014]

Water flow in 1 hour,

= Area of cross-section × Speed of water

$$= 6\times 1.5\times 10000 \text{ m}^3$$

m183

$$= 90000 \text{ m}^3$$

Water flow in 40 minutes,

$$= 90000\times\frac{30}{60} \text{ m}^3$$

$$= 45000 \text{ m}^3$$

Let A be the irrigated area then volume of water in irrigated area is equal to the water flow.

Thus $A\times 0.08 = 45000$

$$A = \frac{45000}{0.08} = 562500 \text{ m}^3$$

$$= 56.25 \text{ hectare.}$$

131. A farmer connects a pipe of internal diameter 20 cm from a canal into a cylindrical tank in his field, which is 10 m in diameter and 2 m deep. If water flows through the pipe at the rate of 3 km/hr, in how much time will the tank be filled ?

Ans : [Board Term-2 2012, Delhi 2015]

Radius of the tank $R = \frac{10}{2} = 5$ m

Depth of tank $D = 2$ m

Volume of tank $V = \pi R^2 D$

$$= \pi(5)^2\times 2 = 50\pi$$

Radius of pipe $r = \frac{20}{2} = 10$ cm $= 0.10$ m

Speed of the water is 3 km/hr.

Speed of water in minute,

$$= \frac{3000}{60} = 50 \text{ m/min}$$

Volume of water supplied in one minute

$$\pi r^2 h = \pi\times 0.10\times 0.10\times 50$$

Time taken to fill the tank,

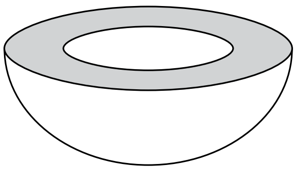
$$t = \frac{50\pi}{\pi\times 0.10\times 0.10\times 50} = 100$$

Hence time taken to fill the tank is 100 minutes.

132. The internal and external diameters of a hollow hemispherical vessel are 16 cm and 12 cm respectively. If the cost of painting 1 cm^2 of the surface area is Rs. 5.00, find the total cost of painting the vessel all over. (Use $\pi = 3.14$)

Ans :

As per question the figure is shown below.



Here $R = 8$ cm, $r = 6$ cm

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

$= \pi[2 \times 8^2 + 2 \times 6^2 + (8^2 - 6^2)]$

$= \pi[2 \times 64 + 2 \times 36 + (64 - 36)]$

$= \pi[128 + 72 + 28]$

$= 228 \times 3.14 = 715.92 \text{ cm}^2$

Total cost $= 715.92 \times 5 = 3579.60$ Rs

133. Water is flowing through a cylindrical pipe, of internal diameter 2 cm, into a cylindrical tank of base radius 40 cm, at the rate of 0.4 m/s. Determine the rise in level of water in the tank in half an hour.

Ans : [Board Term-2 Delhi 2013]

Radius of pipe $r = \frac{2}{2} = 1$

Water flow rate $= 0.4 \text{ m/s} = 40$ cm/s

Volume of water flowing through pipe in 1 sec.

$$\pi r^2 h = \pi \times (1)^2 \times 40 = 40\pi \text{ cm}^3$$

Volume of water flowing in 30 min $(30 \times 60 \text{ sec})$

$$= 40\pi \times 30 \times 60 = 72000\pi$$

Volume of water in cylindrical tank in 30 min,

Now $\pi R^2 H = \pi(40)^2 \times H$

$\pi(40)^2 \times H = 72000\pi$

$40 \times 40 \times H = 72000\pi$

Rise in water level

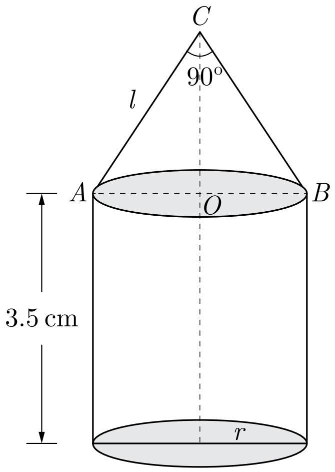
$$H = \frac{72000}{40 \times 40} = 45 \text{ cm.}$$

Thus level of water in the tank is 45 cm.

134. A toy is in the form of a cylinder of diameter $2\sqrt{2}$ m and height 3.5 m surmounted by a cone whose vertical angle is 90°. Find total surface area of the toy.

Ans : [Board Term-2 2012]

As per question the figure is shown below.



Here $\angle C = 90^\circ$ and $AC = BC = l$

Thus $AB^2 = AC^2 + BC^2$

$= l^2 + l^2 = 2l^2$

Now $(2\sqrt{2})^2 = 2l^2$

Thus $l = 2$ and $r = \sqrt{2}$ m

Slant height of conical portion, $l = 2$ m

Total surface area of toy

$2\pi rh + \pi r^2 + \pi rl = \pi r[7 + \sqrt{2} + 2] \text{ m}^2$

$= \pi\sqrt{2}[9 + \sqrt{2}] \text{ m}^2$

$= \pi[2 + 9\sqrt{2}] \text{ m}^2$

135. Find the volume of the largest solid right circular cone that can be cut out off a solid cube of side 14 cm.

Ans : [Board Term-2 2012]

The base of cone is the largest circle that can be inscribed in the face of the cube and the height will be equal to edge of the cube.

Radius of cone, $r = \frac{14}{2} = 7$ cm

Height of cone, $h = 14$ cm

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

$$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 14$$

$$= \frac{2156}{3} = 718.67.$$

136. Water is flowing at the rate of 15 km/hr through a cylindrical pipe of diameter 14 cm into a cuboidal pond which is 50 m long and 44 m wide. In what time the level of water in pond rise by 21 cm ?

Ans : [Board Term-2 2012]

Radius of pipe, $r = \frac{14}{2} = 7$ cm

Cross section area of pipe,

$$\pi r^2 = \frac{22}{7} \times \left(\frac{7}{100}\right)^2$$

Speed of water flowing through the pipe

$$= 15 \text{ km/hr} = 15000 \text{ m/hr}$$

In an hour length of water = 15000 m

Volume of water flowing from pipe in 1 hr,

$$\pi r^2 h = \frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 15000 \text{ m}^3$$

Let t be time taken to fill the tank. Now total volume of water flowing in time t,

$$\pi r^2 ht = \frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 15000t$$

Volume of water flown= Volume of water in tank

$$\pi r^2 ht = l \times b \times y$$

$$\frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 1500t = 50 \times 44 \times \frac{21}{100}$$

$$\frac{22}{7} \times \frac{7}{100} \times \frac{7}{100} \times 15000t = 50 \times 44 \times \frac{21}{100}$$

$$\frac{22}{7} \times \frac{7}{100} \times \frac{7}{100} \times 15000t = 50 \times 44 \times \frac{21}{100}$$

$$22 \times 7 \times 150t = 50 \times 44 \times 21$$

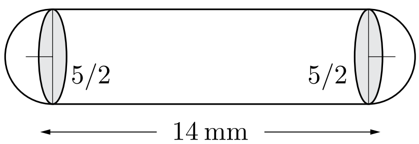
$$t = \frac{50 \times 44 \times 21}{22 \times 150 \times 7} = 2$$

Hence, time taken to fill the tank is 2 hours.

137. A medicine capsule is in the shape of a cylinder with two hemisphere stuck to each of its ends, the length of the entire capsule is 15 mm and the diameter of the capsule is 5 mm. Find the Volume of the capsule.

Ans : [Board Term-2 2012]

As per question the figure is shown below.



Total height = 14 mm

Height of cylinder $= 14 - 2 \times 2.5 = 9$ mm

Radius of cylinder = 2.5mm

Radius of hemisphere = 2.5 mm

Volume of capsule = Volume of two hemispheres + Volume of cylinder

$$= 2 \times \frac{2\pi r^3}{3} + \pi r^2 h$$

$$= \frac{4}{3}\pi\left(\frac{5}{2}\right)^3 + \pi\left(\frac{5}{2}\right)^2 \times 9$$

$$= \pi\left(\frac{5}{2}\right)^2\left(\frac{4}{3} \times \frac{5}{2} + 9\right)$$

$$= \frac{25\pi}{4}\left(\frac{10}{3} + 9\right)$$

$$= \frac{25}{4}\pi\left(\frac{10+27}{3}\right) = \frac{25}{4}\pi\left[\frac{37}{3}\right]$$

$$= \frac{25}{4} \times \frac{22}{7} \times \frac{37}{3} = \frac{10175}{42} \text{ mm}^3$$

$$= 242.26 \text{ mm}^3.$$

138. A milk tanker cylindrical in shape having diameter 2 m and length 4.2 m supplies milk to the two booths in the ratio of 3 : 2. One of the milk booths has cuboidal vessel having base area 3.96 sq. m. and the other has a cylindrical vessel having radius 1 m. Find the level of milk in each of the vessels. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 2012]

Radius of milk tanker $R = \frac{2}{2} = 1$ m

Length of mil tanker L 4.2 m

Volume of milk tanker,

$$\pi R^2 L = \frac{22}{7} \times 1 \times 4.2 = 13.2 \text{ m}^3$$

Supply of milk to booth I,

$$= 13.2 \times \frac{3}{5} = 2.64 \times 3 = 7.92 \text{ m}^3$$

Supply of milk to booth II,

$$= 13.2 \times \frac{2}{5} = 2.64 \times 2 = 5.28 \text{ m}^3$$

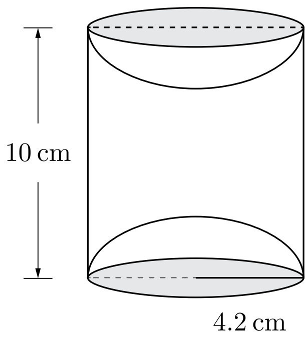
$$\text{Height in } 1^{sh} \text{ vessel} = \frac{7.92}{3.96} = 2 \text{ m}$$

$$\text{Height in } 2^{nd} \text{ vessel} = \frac{5.28}{\frac{22}{7} \times 1} = \frac{5.28 \times 7}{22} = 1.68 \text{ m}$$

139. From each end of a solid metal cylinder, metal was scooped out in hemispherical form of same diameter. The height of the cylinder is 10 cm and its base is of radius 4.2 cm. The rest of the cylinder is melted and converted into a cylindrical wire of 1.4 cm thickness. Find the length of the wire. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 OD 2015]

As per question the figure is shown below.



Volume of cylinder,

$$\pi R^2 H = \pi(4.2)^2 \times 10 \text{ cm}^3$$

Volume of metal scooped out ,

$$= 2 \times \text{Volume of hemisphere}$$

$$= 2 \times \frac{2}{3} \times \pi r^3 = \frac{4}{3}\pi r^3$$

$$= \frac{4\pi}{3}(4.2)^3$$

Volume of rest of cylinder,

$$= \pi(4.2)^2 \times 10 - \frac{4\pi}{3}(4.2)^3 \text{ cm}^3$$

$$= \pi(4.2)^2\left(10 - \frac{4}{3} \times 4.2\right) \text{ cm}^3$$

$$= \pi(4.2)^2(10 - 5.6) \text{ cm}^3$$

$$= \pi(4.2)^2 \times 4.4 \text{ cm}^3$$

Now from rest volume a wire of thickness 1.4 cm i.e radius 0.7 cm is formed. Let l be length of wire. Volume of wire and rest cylinder will be equal.

Volume of wire,

$$\pi r^2 l = \pi(4.2)^2 \times 4.4 \text{ cm}^3$$

$$\pi(0.7)^2 l = \pi(4.2)^2 \times 4.4 \text{ cm}^3$$

$$l = \frac{4.2 \times 4.2 \times 4.4}{07 \times 0.7} \text{ cm}^3$$

$$= 6 \times 6 \times 4.4 = 158.4 \text{ cm}$$

140. 150 spherical marbles, each of diameter 1.4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, which are completely immersed in water. Find the rise in the level of water in the vessel.

Ans : [Board Term-2 OD 2014]

Radius of spherical marble $r_1 = \frac{1.4}{2} = 0.7$ cm

Radius of cylindrical vessel $R = \frac{7}{2} = 3.5$ cm

Let h be the rise in water level then,

Volume of 150 spherical marbles = Volume of water rise

$$150 \times \frac{4\pi}{3} \times \left(\frac{7}{10}\right)^3 = \pi \times \left(\frac{7}{2}\right)^2 \times h$$

$$150 \times \frac{4}{3} \times \frac{7}{10} \times \frac{7}{10} \times \frac{7}{10} = \frac{7}{2} \times \frac{7}{2} \times h$$

$$h = \frac{4 \times 7}{5}$$

$$\frac{28}{5} = h \Rightarrow h = 5.6 \text{ cm}$$

Thus 5.6 cm will be rise in the level of water.

141. A solid cylinder of diameter 12 cm and height 15 cm is melted and recast into toys in the shape of a cone of radius 3 cm and height 9 cm. Find the number of toys formed so.

Ans : [Board Term-2 OD Compt. 2017]

Height of cylinder, $H = 15$ cm

Radius of cylinder, $R = \frac{12}{2} = 6$ cm

Radius of cone $r = 3$ cm

Height $h = 9$ cm

Let the number of toys recast be n.

Volume of n conical toys = Volume of cylinder

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

$$n \times \frac{1}{3} \times 3 \times 3 \times 9 = 6 \times 6 \times 15$$

$$n = \frac{6 \times 6 \times 15}{3 \times 9} = 20$$

Hence the number of toys is 20.

142. A well diameter 3 m is dug 14 m deep. The soil taken out of it is spread evenly around it to a width of 5 m. to form a embankment. Find the height of the embankment.

Ans : [Board Term-2 Foreign 2017]

The volume of soil taken out from the well,

$$\pi^2 rh = \pi \times \left(\frac{3}{2}\right)^2 \times 14 \text{ m}^3$$

The radius of embankment with well

$$= \frac{3}{5} + 5 = \frac{13}{2} \text{ m}$$

Let the y be height of embankment. Then the volume of soil used in embankment,

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

$$\pi\left[\left(\frac{13}{2}\right)^2 - \left(\frac{3}{2}\right)^2\right]y = \pi \times \left(\frac{3}{2}\right)^2 \times 14$$

$$\frac{160}{4}y = \frac{3}{2} \times \frac{3}{2} \times 14$$

$$y = \frac{3 \times 3 \times 14}{160} = 0.7875 \text{ m}$$

Hence the height of embankment is 78.75 cm.

143. Water is flowing at the rate of 5 km/hour through a pipe of diameter 14 cm into a rectangular tank of dimensions 50 m $\times$ 44 m. Find the time in which the level of water in the tank will rise by 7 cm.

Ans : [Board Term-2 Delhi Compt. 2017]

Radius of pipe, $r = \frac{14}{2} = 7$ cm

Cross section area of pipe,

$$\pi r^2 = \frac{22}{7} \times \left(\frac{7}{100}\right)^2$$

Speed of water flowing through the pipe

$$= 5 \text{ km/hr} = 15000 \text{ m/hr}$$

In an hour length of water $= 5000$ m

Volume of water flowing from pipe in 1 hr,

$$\pi r^2 h = \frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 5000 \text{ m}^3$$

Let t be time taken to fill the tank. Now total volume of water flowing in time t,

$$\pi r^2 ht = \frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 5000t$$

Volume of water flown= Volume of water in tank

$$\pi r^2 ht = l \times b \times y$$

$$\frac{22}{7} \times \left(\frac{7}{100}\right)^2 \times 500t = 50 \times 44 \times \frac{7}{100}$$

$$\frac{22}{7} \times \frac{7}{100} \times \frac{7}{100} \times 5000t = 50 \times 44 \times \frac{7}{100}$$

$$22 \times 50t = 50 \times 44$$

$$t = \frac{50 \times 44}{22 \times 50} = 2$$

Hence, Time taken to fill the tank is 2 hours.

144. From a rectangular block of wood, having dimensions 15 cm $\times$ 10 cm $\times$ 3.5 cm, a pen stand is made by making four conical depressions. The radius of each one of the depression is 0.5 cm and the depth 2.1 cm. Find the volume of wood left in the pen stand.

Ans : [Board Term-2 Delhi Compt. 2017]

Volume of cuboidal block

$$l \times b \times h = 15 \times 10 \times 3.5 \quad 525 \text{ cm}^3$$

Volume of one cone

$$\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 0.5 \times 0.5 \times 2.1 \text{ cm}^3$$

$$= 0.55 \text{ cm}^3$$

Volume of 4 cones

$$4 \times \frac{\pi r^2 h}{3} = 0.55 \times 4 = 2.2 \text{ cm}^3$$

Volume of wood remaining in pen stand

$$= 525 - 2.2 = 522.80 \text{ cm}^3$$

145. The ratio of the volumes of two spheres is $8 : 27$. If r and R are the radii of sphere respectively, then find the $(R - r) : r$.

Ans : [Board Term-2 2012]

Ratio of volumes

$$\frac{\text{Volume of 1}^{\text{st}}\text{sphere}}{\text{Volume of 2}^{\text{nd}}\text{sphere}} = \frac{\frac{4}{3}\pi r^3}{\frac{4}{3}\pi R^3} = \frac{8}{27}$$

$$\frac{r^3}{R^3} = \frac{8}{27}$$

$$\frac{r}{R} = \frac{2}{3}$$

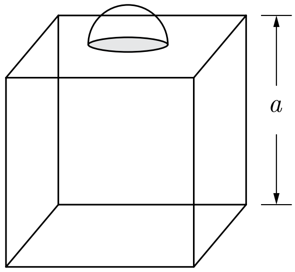
$$\frac{r}{R - r} = \frac{2}{3 - 2} = \frac{2}{1}$$

$$\frac{R - r}{r} = \frac{1}{2}$$

146. A decorative block, made up of two solids - a cube and a hemisphere. The base of the block is a cube of side 6 cm and the hemisphere fixed on the top has a diameter of 3.5 cm. Find the total surface area of the block. Use $\pi = \frac{22}{7}$.

Ans : [Board Term-2 Delhi 2016]

Let a be the side of cube and r be the radius of hemisphere. As per question the figure is shown below.



Surface area of block

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

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

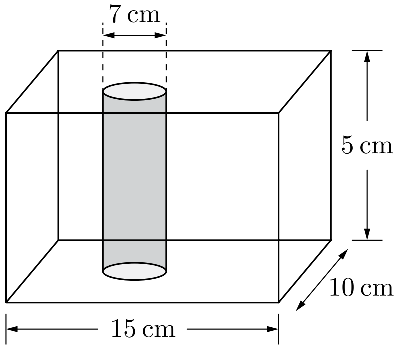
$$= 6 \times (6)^2 + \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2}$$

$$= 225.625 \text{ cm}^2.$$

147. In fig., from a cuboidal solid metallic block of dimensions 15 cm × 10 cm × 5 cm, a cylindrical hole of diameter 7 cm is drilled out. Find the surface area of the remaining block. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 Delhi 2015]

As per question the figure is shown below.



We have $l = 15$ cm, $b = 10$ cm, $h = 5$cm, $r = \frac{7}{2}$ cm

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

TSA of cuboidal block

$$= 2(15 \times 10 + 10 \times 5 + 5 \times 15)$$

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

Area of curved surface cylinder,

$$2\pi rh = 2 \times \frac{22}{7} \times \frac{7}{2} \times 5 = 110 \text{ cm}^2$$

$$\text{Area of two circular bases} = 2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$$

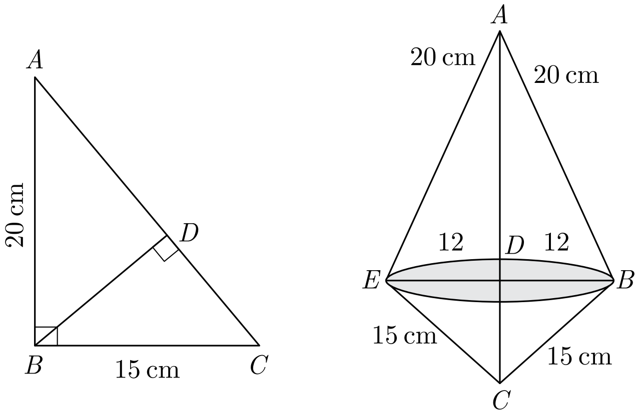
$$= 77 \text{ cm}^2$$

$$\text{Required area} = 550 + 110 - 77 = 583 \text{ cm}^3.$$

148. A right triangle whose sides are 15 cm is made to revolve about its hypotenuse. Find the volume and the surface area of the double cone so formed. (Use $\pi = 3.14$)

Ans : [Board Term-2 2012]

As per question the figure is shown below.



We have

$$AC^2 = 20^2 + 15^2 = 625$$

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

$$\text{area}(\Delta ABC) = \text{area}(\Delta ABC)$$

$$\frac{1}{2} \times AC \times BD = \frac{1}{2} \times BC \times AB$$

$$25 \times BD = 15 \times 20 = 300$$

$$BD = 12 \text{ cm}$$

Volume of double cone,

$$= \text{Volume of upper cone} + \text{Volume of lower cone}$$

$$= \frac{1}{3}\pi(BD)^2 \times AD + \frac{1}{3}\pi(BD)^2 \times CD$$

$$= \frac{1}{3}\pi(BD)^2(AD + CD)$$

$$= \frac{1}{3}\pi(BD)^2(AC)$$

$$= \frac{1}{3} \times 3.14 \times (12)^2 \times 25$$

$$= \frac{1}{3} \times 3.14 \times 144 \times 25 = 3768 \text{ cm}^2$$

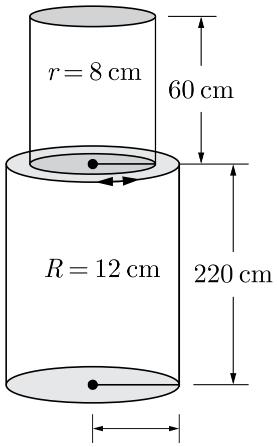
Surface area= CSA of upper cone + CSA of lower cone

$$= \pi(12)(20) + \pi(12)(15)$$
$$= 12\pi\{20 + 15\}$$
$$= 12 \times 3.14 \times 35$$
$$= 1318.8 \text{ cm}^2$$

149. A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pipe, given that 1 cm^3 of iron has approximately 8 g mass. (Use $\pi = 3.14$)

Ans : [Board 2019 OD, 2012]

As per question the figure is shown below.



Radius of lower cylinder, $R = 12$ cm

Height of lower cylinder, $H = 220$ cm

Radius of upper cylinder, $r = 8$ cm

Height of upper cylinder, $h = 60$ cm

Volume of solid iron pole,

$$\pi R^2 H + \pi r^2 h = 3.14 \times (12)^2 \times 220 + 3.14 \times (8)^2 \times 60$$
$$= 111532.8 \text{ cm}^3$$

$$\text{Mass of pole} = 111532.8 \times 8 \text{ g}$$
$$= 892262.4 \text{ g}$$
$$= 892.2624 \text{ kg.}$$

150. A heap of wheat is in the form of cone of diameter 6 m and height 3.5 m. Find its volume . How much canvas cloth is required to just cover the heap ? Use $\pi = \frac{22}{7}$

Ans :

Radius of cone, $r = \frac{6}{2} = 3$ cm

Height of cone, $h = 3.5$ cm

Volume of wheat in the form of cone

$$V = \frac{1}{3}\pi r^2 h$$
$$= \frac{1}{3} \times \frac{22}{7} \times 3 \times 3 \times 3.5$$
$$= 11 \times 3 = 33 \text{ m}^3$$
$$l = \sqrt{3^2 + 3.5} = 4.609 \text{ m}$$

Canvas required to cover the heap,

$$\pi r l = \frac{22}{7} \times 3 \times 4.609$$
$$= 43.45 \text{ m}^2.$$

151. A vessel full of water is in the form of an inverted cone of height 8 cm and the radius of its top, which is open, is 5 cm. 100 spherical lead balls are dropped into vessel. One-fourth of the water flows out of the vessel. Find the radius of a spherical ball.

Ans : [Board Term-2 Foreign 2015]

Volume of water in cone

$$\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times (5)^3 \times 8 = \frac{200}{3}\pi \text{ cm}^3$$

Volume of water flows out

$$= \frac{1}{4} \times \frac{200}{3}\pi = \frac{50}{3}\pi \text{ cm}^3$$

Let r be the radius of one spherical ball.

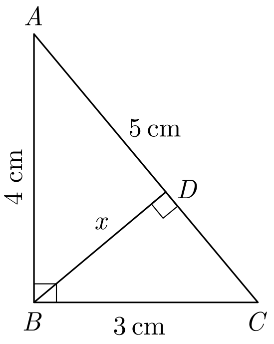
Volume of 100 spherical ball,

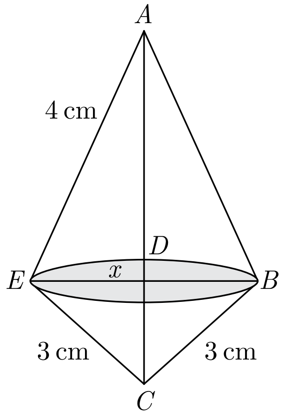
$$\frac{4}{3}\pi r^3 \times 100 = \frac{50}{3}\pi$$
$$r^3 = \frac{50}{4 \times 100} = \frac{1}{8}$$
$$r = \frac{1}{2} = 0.5 \text{ cm}$$

152. A right angled triangle whose sides are 3 cm, 4 cm and 5 cm is revolved about the longest side. Find the surface area of figure obtained. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 2012]

As per question the figure is shown below.





By revolving right triangle about longest side double cone is generated. Let x be radius of double cone.

$$\text{area}(\Delta\,ABC) = \text{area}(\Delta\,ABC)$$

$$\frac{1}{2}\times 5\times x = \frac{1}{2}\times 3\times 4$$

$$x = \frac{12}{5} = 2.4 \text{ cm}$$

Surface area of double cone,

$$\pi r l_1 + \pi r l_2 = \pi x(l_1 + l_2)$$

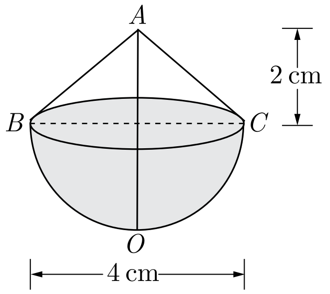
$$= \frac{22}{7}\times 2.4\times(3+4)$$

$$= 22\times 2.4 = 52.8 \text{ cm}^2.$$

153. A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm and the diameter of the base is 4 cm. Determine the volume of the toy. If a right circular cylinder circumscribes the toy, find the difference of the volume of the cylinder and toy. (Use $\pi = 3.14$)

Ans : [Board Term-2 2012]

Let BOC is a hemisphere and ABC is a cone. As per question the figure is shown below.



Radius of hemisphere is equal to the radius of cone which is $\frac{4}{2} = 2$ cm.

Height of cone, $h = 2$ cm

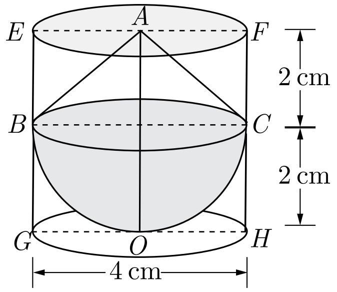
$$\text{Volume of toy} = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$$

$$\frac{1}{3}\pi r^2(2r+h) = \frac{1}{3}\times 3.14\times 2\times 2(2\times 2+2)$$

$$= \frac{1}{3}\times 3.14\times 4\times 6$$

$$= 25.12 \text{ cm}^3$$

Let right circular cylinder $EFGH$ circumscribe the given solid toy.



Radius of cylinder = 2 cm

Height of cylinder = 4 cm

Volume of right circular cylinder

$$\pi r^2 h = 3.14\times(2)^2\times 4 \text{ cm}^3$$

$$= 50.24 \text{ cm}^3$$

Difference of two volume

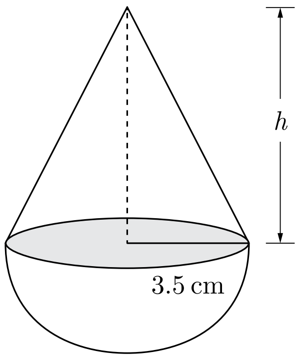
$$= \text{Volume of cylinder} - \text{Volume of toy}$$

$$= 50.24 - 25.12 = 25.12 \text{ cm}^3.$$

154. A solid wooden toy is in the form of a hemisphere surmounted by a cone of same radius. The radius of hemisphere is 3.5 cm and the total wood used in the making of toy is $166\frac{5}{6}$ cm^3. Find the height of the toy. Also find the cost of painting the hemisphere part of the toy at the rate of Rs. 10 per cm^2. Use $\pi = \frac{22}{7}$

Ans : [Board Term-2 Delhi 2015]

As per question the figure is shown below.



Radius of hemisphere is equal to the radius of cone which is 3.5 cm.

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

$$166\frac{5}{6} = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$$

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

$$1001 = 2\pi r^2 (2r + h)$$

$$1001 = 2 \times \frac{22}{7} \times (3.5)^2 (2 \times 3.5 + h)$$

$$1001 = 22 \times 3.5 \times (7 + h)$$

$$91 = 2 \times 3.5 \times (7 + h)$$

$$13 = 7 + h \Rightarrow h = 6$$

Height of the toy $= 6 + 3.5 = 9.5$ cm.

CSA of hemisphere,

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

$$\text{Cost of painting} = 10 \times 77 = 770 \text{ Rs}$$

155. Water is flowing at the rate of 2.52 km/h through a cylindrical pipe into a cylindrical tank, the radius of whose base is 40 cm. If the increase in the level of the water in the tank, in half an hour is 3.15 m, find the internal diameter of the pipe.

Ans : [Board Term-2 Delhi 2015]

Let r be the internal radius of the pipe, then cross section area of pipe is πr^2.

Speed of water flowing through the pipe

$$= 2.52 \text{ km/hr} = 2520 \text{ m/hr}$$

In an hour length of water $= 2520$ m

Volume of water flowing from pipe in 1 hr,

$$\pi r^2 h = \pi r^2 2520 \text{ m}^3$$

In 30 minute or in 0.5 hour,

Volume of water flown= Volume of water in tank

$$\pi r^2 2520 \times 0.5 = \pi \times (0.4)^2 \times 3.15$$

$$1260 r^2 = 0.4 \times 0.4 \times 3.15$$

$$400 r^2 = 0.4 \times 0.4$$

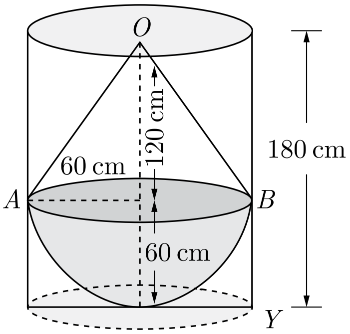
$$20r = 0.4 \Rightarrow r = \frac{0.4}{20} = 0.02 \text{ m}$$

Internal radius is 2 cm and diameter of pipe is 4 cm.

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

Ans : [Board Term-2, 2015]

As per question the figure is shown below.



Height of cone, $h = 120$ cm,

Radius of cone, $r = 60$ cm

Radius of hemisphere, $r = 60$ cm.

Height of cylinder, $H = 180$ cm,

Radius of cylinder, $R = 60$ cm

Radius of cone, hemisphere and cylinder is equal to $r = 60$ cm

Volume of solid,

$$V_{\text{solid}} = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$

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

$$= \frac{\pi r^2}{3} \times 240 = 80\pi r^2$$

Volume of water in the cylinder is equal to the volume of cylinder.

$$V_{\text{cylinder}} = \pi r^2 h$$

$$= \pi \times r^2 \times 180 = 180\pi r^2$$

Water left in the cylinder is equal to the difference of the volume of water in cylinder and volume of solid.

Water left in the cylinder,

$$= V_{\text{cylinder}} - V_{\text{solid}}$$

$$= 180\pi r^2 - 80\pi r^2$$

$$= 100\pi r^2$$

$$= 100 \times \frac{22}{7} \times (60)^2$$

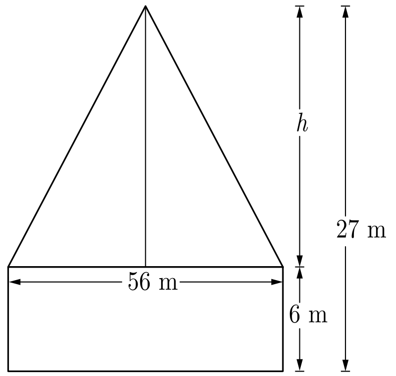
$$= \frac{100 \times 22 \times 60 \times 60}{7}$$

$$= 1131428 \text{ cm}^3$$

157. A circus tent is in the shape of a cylinder surmounted by a conical top of same diameter. If their common diameter is 56 m, the height of cylindrical part is 6 m and the total height of the tent above the ground is 27 m, find the area of canvas used in the tent.

Ans : [Board Term-2 Delhi Compt. 2017]

As per question the figure is shown below.



Total height of tent $H_{\text{Total}} = 27$ m

Height of cylindrical part $h = 6$ m

Height of conical part $H = 27 - 6 = 21$ m

Radius of cone $R = \frac{56}{2} = 28$ m

Radius of cylinder $R = \frac{56}{2} = 28$ m

Slant height of cone $L = \sqrt{R^2 + H^2}$

$$= \sqrt{28^2 + 21^2}$$

$$= \sqrt{784 + 441} = \sqrt{1225}$$

$$= 35 \text{ m}$$

Area of canvas used,

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

$$= \frac{22}{7} \times 28(2 \times 6 + 35)$$

$$= 22 \times 4 \times 47$$

$$= 4136 \text{ m}^2$$

158. From a right circular cylinder of height 2.4 cm and radius 0.7 cm, a right circular cone of same radius is cut-out. Find the total surface area of the remaining solid.

Ans : [Board Term-2 OD 2017]

Radius of cylinder and cone,

$$r = 0.7 \text{ cm}$$

Height of cylinder and cone,

$$h = 2.4 \text{ cm}$$

Slant height of cone

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

$$= \sqrt{0.7^2 + 2.4^2} = 2.5 \text{ m}$$

Total surface area of remaining solid,

= CSA of cylinder + CSA of cone + Area of top.

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

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

$$= \frac{22}{7} \times 0.7(2 \times 2.4 + 2.5 + 0.7)$$

$$= \frac{22}{7} \times 0.7 \times 8 = \frac{176}{10}$$

Hence total surface area is 17.6 cm^2