Mensuration II: Volume and Surface Area

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INTRODUCTION

Solids

A *solid* is a figure bounded by one or more surfaces. It has three dimensions, namely, length, breath or width, and thickness or height. The plane surfaces that bind it are called its *faces*.

The *volume* of any solid figure is the amount of space enclosed within its bounding faces. It is measured in cubic units, e.g., m^3, cm^3, etc.

The area of the plane surfaces that bind the solid is called its *surface area*.

For any regular solid,

Number of faces + Number of vertices

= Number of edges + 2.

We discuss here some important three-dimensional figures and the formulae associated with them.

Cubic

It is ta solid figure which has six rectangular faces. It is also called *rectangular parallelopiped.*

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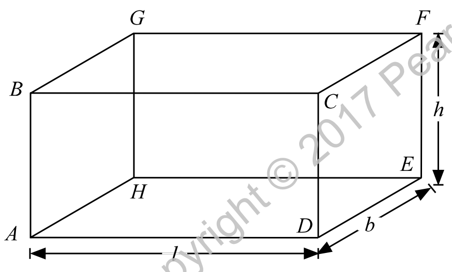
SOME BASIC FORMULAE



If l, b and h denote the length, breadth and height of the cuboid, and d denotes the body diagonal (AF or BE or DG or CH), then

(i) Volume = $l \times b \times h = \sqrt{A_1 \times A_2 \times A_3}$,

where, A_1 = area of base or top,

A_2 = area of one side face, and

A_3 = area of other side face.

(ii) Total surface area = $2(lb + bh + lh)$

$= (l + b + h)^2 - d^2$

(iii) Diagonal of cuboid = $\sqrt{l^2 + b^2 + h^2}$

Notes:

1. For painting the surface area of a box or to know how much tin sheet is required for making a box, we use formula (ii).
2. To find how much a box contains or how much space a box shall occupy, we use formula (i). To find the length of the longest pole to be placed in a room, we use formula (iii).
3. The rise or fall of liquid level in a container

$$= \frac{\text{Total volume of objects submerged or taken out}}{\text{Cross-sectional area of container}}.$$

Illustration 1: Find the volume and the total surface area of a cuboid whose dimensions are 25 m, 10 m and 2 m.

Solution: Here, l = 25 m, b = 10 m and h = 2 m.

Volume of the cuboid $= l \times b \times h$

$= 25 \times 10 \times 2$

$= 500$ m^3

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Total surface area of the cuboid

$$= 2\,(lb + bh + lh)$$
$$= 2\,(25 \times 10 + 10 \times 2 + 25 \times 2)$$
$$= 2\,(250 + 20 + 50)$$
$$= 640 \text{ m}^2.$$

Illustration 2: Find out the length of the longest bamboo that can be placed in a room which is 12 m long, 9 m broad and 8 m high.

Solution: Length of the bamboo

= length of the diagonal of the room

$$= \sqrt{12^2 + 9^2 + 8^2}$$
$$= \sqrt{289} = 17 \text{ m}.$$

Illustration 3: The area of a side of a box is 120 cm^2. The area of the other side of the box is 27 cm^2. If the area of the upper surface of the box is 60 cm^2, then find out the volume of the box.

Solution: Volume to the box

$$= \sqrt{\text{area of base} \times \text{area of one face} \times \text{area of the other face}}$$
$$= \sqrt{60 \times 120 \times 72}$$
$$= \sqrt{518400} = 720 \text{ cm}^3.$$

Illustration 4: The sum of length, breadth and height of a cuboid is 12 cm. Find out the total surface area of the cuboid.

Solution: Total surface area

$$= (\text{Sum of all three sides})^2 - (\text{Diagonal})^2$$
$$= 12^2 - 8^2 = 144 - 64 = 80 \text{ cm}^2.$$

Cube

It is a special type of cuboid in which each face is a square.

For a cube, length, breadth and height are equal and is called, the edge of the cube,

If a be the edge of a cube, then

(i) Volume of the cube = (edge)^3 = a^3

(ii) Total surface area of the cube = 6 (edge)^2 = $6a^2$

(iii) Diagonal of the cube = $\sqrt{3}a$ (edge) = $\sqrt{3}a$

(iv) Volume of the cube = $\left(\dfrac{\text{diagonal}}{\sqrt{3}}\right)^3 = \left(\dfrac{d}{\sqrt{3}}\right)^2$

$$= \left(\sqrt{\frac{\text{Surface area}}{6}}\right)^3$$

(v) Total surface area of the cube

$$= 2\,(\text{diagonal})^2 = 2d^2$$

(vi) For two cubes

(a) Ratio of volumes = (ratio of sides)^3

(b) Ratio of surface areas = (Ratio of sides)^2

(c) (Ratio of surface areas)^3 = (Ratio of volumes)^2.

Illustration 5: Find out the volume, surface area and the diagonal of a cube, each of whose sides measures 4 cm.

Solution: Volume of the cube = a^3 = $(4)^3$ = 64 cm^3.

Surface area of the cube = $6a^2$ = 6 $(4)^2$ = 96 cm^2.

Diagonal of the cube = $\sqrt{3}a = 4\sqrt{3}$ cm.

Illustration 6: The surface area of a cube is 216 cm^2. Find out its volume.

Solution: Volume of the cube

$$= \left(\sqrt{\frac{\text{Surface area}}{6}}\right)^3$$
$$= \left(\sqrt{\frac{216}{6}}\right)^3 = (6)^3 = 216 \text{ cm}^3.$$

Illustration 7: The diagonal of a cube is $8\sqrt{3}$ cm. Find out its total surface area and volume.

Solution: We have,

Diagonal of cube = $\sqrt{3}$ (edge)

$$\therefore \quad \text{Edge of cube} = \frac{\text{Diagonal of cube}}{\sqrt{3}}$$
$$= \frac{8\sqrt{3}}{\sqrt{3}} = 8 \text{ cm}.$$

Total surface area = 6 (edge)^2 = $6(8)^2$

= 384 cm^2.

Volume of cube = (edge)^3 = $(8)^3$ = 512 cm^3.

Illustration 8: If the volumes of two cubical blocks are in the ratio of 8:1, then what will be the ratio of their edges?

Solution: We have,

Ratio of volumes = (Ratio of sides)^3

Since, ratio of volumes = 8:1, i.e., $2^3:1^3$

$\therefore$ ratio of sides = 2:1.

Illustration 9: Volumes of the two cubes are in the ratio of 1:9. Find the ratio of their surface areas.

Solution: (Ratio of the surface areas)^3

= (Ratio of volumes)^2

$\therefore$ Ratio of surface areas = $\sqrt[3]{1:81}$ = 1:3 $(3)^{1/3}$.

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Illustration 10: Sides of two cubes are in the ratio of 2:3. Find out the ratio of their surface areas.

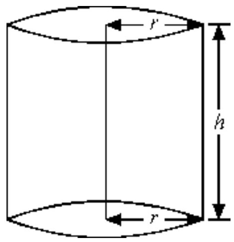
Solution: Ratio of surface areas

$= (\text{Ratio of sides})^2$

$= (2:3)^2 = 4:9.$

Right Circular Cylinder

A *right circular cylinder* is a solid with circular ends of equal radius and the line joining their centres perpendicular to them. This is called, axis of the cylinder. The length of the axis is called, the height of the cylinder.



Note:

Take a rectangular sheet of paper and role it lengthwise or breadthwise in a round way, you will get a cylinder, i.e., a cylinder is generated by rotating a rectangle by fixing one of its sides.

If r is the radius of base and h is the height of the cylinder, then

(i) Volume of cylinder

$= \text{Area of the base} \times \text{height}$

$= \pi r^2 \times h = \pi r^2 h$ cubic units

(ii) Area of the curved surface

$= \text{Circumference of the base} \times \text{height}$

$= 2\pi r \times h = 2\pi rh$ sq units

(iii) Area of the total surface

$= \text{Area of the curved surface} + \text{Area of the two circular ends}$

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

$= 2\pi r(h + r)$ sq units.

(iv) For two cylinders,

When radii are equal

(a) Ratio of volumes = Ratio of heights

(b) Ratio of volumes = Ratio of curved surface areas

(c) Ratio of curved surface areas = Ratio of heights

When heights are equal

(a) Ratio of volumes = $(\text{Ratio of radii})^2$

(b) Ratio of volumes = $(\text{Ratio of curved surface areas})^2$

(c) Radii of curved surface areas = Ratio of radii

When volumes are equal

(a) Ratio of radii $= \sqrt{\text{Inverse ratio of heights}}$

(b) Ratio of curved surface areas = Inverse ratio of radii

(c) Ratio of curved surface areas $= \sqrt{\text{Ratio of heights}}$

When curved surface areas are equal

(a) Ratio of radii = Inverse ratio of heights

(b) Ratio of volumes = Inverse ratio of heights

(c) Ratio of volumes = Ratio of radii

(v) For a cylinder

(a) Ratio of radii = (Ratio of curved surfaces) × (Inverse ratio of heights)

(b) Ratio of heights = (Ratio of curved surfaces) × (Inverse ratio of radii)

(c) Ratio of curved surfaces = (Ratio of radii) × (Ratio of heights).

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Illustration 11: The diameter of the base of a right circular cylinder is 28 cm and its height is 10 cm. Find out the volume and area of the curved surface of the cylinder.

Solution: Radius of the base $= \frac{28}{2} = 14$ cm.

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

$= \frac{22}{7} \times 14 \times 14 \times 10$

$= 6160 \text{ cm}^3.$

Area of the curved surface $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 14 \times 10$

$= 880 \text{ cm}^2.$

Illustration 12: A cylinder of height 21 cm has base of radius 4 cm. Find out the total surface area of the cylinder.

Solution: Total surface area $= 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 4 \times (21 + 4)$

$= \frac{4400}{7} = 628\frac{4}{7} \text{ cm}^2.$

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Illustration 13: A rectangular piece of paper is 71 cm long and 10 cm wide. A cylinder is formed by rolling the paper along its breadth. Find out the volume of the cylinder. $\left[\text{Take } \pi = \frac{355}{113}\right]$

Solution: Circumference of the paper = Breadth of the paper

$\Rightarrow \quad 2\pi r = 10$

$\Rightarrow \quad r = \frac{10}{2\pi} = \frac{10 \times 113}{2 \times 355} = \frac{113}{71}$ cm.

As the length of the paper becomes the height of the cylinder,

$\therefore$ Volume of the cylinder

$= \pi r^2 l$

$= \frac{355}{113} \times \frac{113}{71} \times \frac{113}{71} \times 71 = 565 \text{ cm}^3.$

Illustration 14: Two circular cylinders of equal volume have their heights in the ratio of 9:16. Find out the ratio of their radii.

Solution: Ratio of radii = $\sqrt{\text{inverse ratio of heights}}$

$= \sqrt{16:9} = 4:3.$

Illustration 15: Two circular cylinders of equal volume have their heights in the ratio of 16:25. Find out the ratio of their curved surface areas.

Solution: Ratio of curved surface areas

$= \sqrt{\text{Ratio of heights}} = \sqrt{16:25} = 4:5.$

Illustration 16: Two circular cylinders of equal volume have their radii in the ratio of 4:9. Find out the ratio of their curved surface areas.

Solution: Ratio of curved surface areas

= inverse ratio of radii = 9:4.

Illustration 17: Two circular cylinders of equal heights have their radii in the ratio of 2:5. Find out the ratio of their volumes.

Solution: Ratio of volumes = $(\text{Ratio of radii})^2$ = 4:25.

Illustration 18: Two circular cylinders of equal heights have their curved surface areas in the ratio of 3:5. Find out the ratio of their volumes.

Solution: Ratio of volumes

= $(\text{Ratio of curved surface areas})^2$

= 9:25.

Illustration 19: Two circular cylinders of equal curved surface areas have their heights in the ratio of 4:7. Find out the ratio of their volumes.

Solution: Ratio of volumes = Inverse ratio of heights

$= \frac{1}{4} : \frac{1}{7} = 7:4.$

Illustration 20: Two circular cylinders of equal curved surface areas have their heights in the ratio of 4:5. Find out the ratio of their volumes.

Solution: Ratio of volumes = Inverse ratio of heights

$= \frac{1}{4} : \frac{1}{5} = 5:4.$

> (vi) If the ratio of heights and the ratio of radii of two right circular cylinders are given, then
>
> Ratio of curved surface areas = (ratio of radii) (ratio of heights).

Illustration 21: If the heights and the radii of two right circular cylinders are in the ratio 2:3 and 4:5, respectively. Find out the ratio of their curved surface areas.

Solution: Ratio of curved surface areas = (ratio of radii) (ratio of heights)

= (4:5) (2:3) = 8:15.

> (vii) If the ratio of heights and the ratio of curved surface areas of two right circular cylinders are given, then
>
> Ratio of radii = (ratio of curves surface areas) (inverse ratio of heights).

Illustration 22: The heights and curved surface areas of two right circular cylinders are in the ratio 3:4 and 5:8, respectively. Find out the ratio of their radii.

Solution: Ratio of radii = (ratio of curved surface areas) (inverse ratio of heights)

$= (5:8) \left(\frac{1}{3} : \frac{1}{4}\right) = (5:8)\ (4:3) = 5:6.$

> (viii) If the ratio of radii and the ratio of curved surface areas of two right circular cylinders are given, then
>
> Ratio of heights = (ratio of curved surface areas) (inverse ratio of radii)

Illustration 23: The radii of two right circular cylinders are in the ratio of 3:4 and their curved surface areas are in the ratio of 5:6. Find out the ratio of their heights.

Solution: Ratio of heights = (ratio of curved surface areas) (inverse ratio of radii)

$= (5:6) \left(\frac{1}{3} : \frac{1}{4}\right)$

$= (5:6)\ (4:3) = 10:9.$

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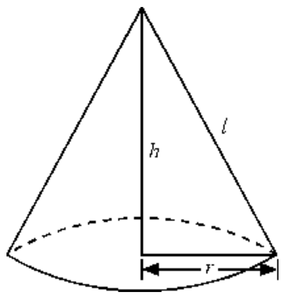
Right Circular Cone

A *right circular cone* is a solid obtained by rotating a right-angled triangle around its height.



If r = radius of base; h = height,

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

(i) Volume of cone

$= \frac{1}{3} \times$ area of the base $\times$ height

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

(ii) Area of curved surface = πrl

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

(iii) Total surface area of cone

= Area of the base + area of the curved surface

$= \pi r^2 + \pi rl = \pi r(r + l)$ sq units.

(iv) For two cones

(a) When volumes are equal
Ratio of radii = $\sqrt{\text{inverse ratio of heights}}$

(b) When radii are equal
Ratio of volumes = Ratio of heights

(c) When heights are equal
Ratio of volumes = (ratio of radii)^2

(d) When curved surface areas are equal
Ratio of radii = inverse ratio of slant heights.

Illustration 24: Find out the slant heights of a cone whose volume is 1232 cm^3 and radius of the base is 7 cm.

Solution: Volume of the cone = $\frac{1}{3}\pi r^2 h$ = 1232

$$\Rightarrow \quad h = \frac{1232 \times 3}{\pi r^2} = \frac{1232 \times 3 \times 7}{22 \times 7 \times 7} = 24 \text{ cm.}$$

Slant height l is given by the relation

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

$$= \sqrt{(24)^2 + (7)^2} = \sqrt{576 + 49}$$

$$= \sqrt{625} = 25 \text{ cm.}$$

$\therefore$ Slant height of the cone is 25 cm.

Illustration 25: A tent is of diameter 12 m at the base and its height is 8 m.

(i) Find the slant height; and

(ii) The canvas required in m^2.

How many persons can the tent accommodate, at the most, if each person requires 18 m^3 of air?

Solution: Diameter of the base of a conical tent = 12 m.

$\therefore$ Radius (r) = $\frac{12}{2}$ = 6 m and its height (h) = 8 m.

(i) Slant height (l) = $\sqrt{r^2 + h^2} = \sqrt{6^2 + 8^2}$

$= \sqrt{64 + 36} = \sqrt{100}$ = 10 m.

(ii) Area of canvas required

$= \pi \times r \times l$

$= \frac{22}{7} \times 6 \times 10 = 188.57$ m

(iii) Volume of conical portion

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

$= \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 8 = 301.71$ m^3.

Space required for each person = 18 m^3.

$\therefore$ Number of persons that can be accommodated

$= \frac{301.71}{18} = 16.$

Illustration 26: The height of a cone is 21 cm and radius of its base is 28 cm. Find out its total surface area.

Solution: We have, r = 28 cm and h = 21 cm.

Slant height (l) = $\sqrt{r^2 + h^2} = \sqrt{(28)^2 + (21)^2}$

$= \sqrt{1225}$ = 35 cm.

Total surface area = $\pi r (l + r)$

$= \frac{22}{7} x\ 28 \times (35 + 28)$

$= \frac{22}{7} \times 28 \times 63$

= 5544 cm^2.

Illustration 27: Two right circular cones of equal curved surface areas have their slant heights in the ratio of 3:5. Find out the ratio of their radii.

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Solution: Ratio of radii = inverse ratio of slant heights

$$= \frac{1}{3} : \frac{1}{5} = 5:3.$$

Illustration 28: Two right circular cones of equal volumes have their heights in the ratio of 4:9. Find out the ratio of their radii.

Solution: Ratio of radii $= \sqrt{\text{inverse ratio of heights}}$

$$= \sqrt{\frac{1}{4} : \frac{1}{9}} = \sqrt{9:4} = 3:2.$$

Illustration 29: Two right circular cones of equal heights have their radii in the ratio of 1:3. Find out the ratio of their volumes.

Solution: Ratio of volumes = (Ratio of radii)^2

$$= (1:3)^2 = 1:9.$$

(v) If the ratio of volumes and the ratio of heights of two right circular cones (or cylinders) are given, then

Ratio of radii

$$= \sqrt{(\text{ratio of volumes})(\text{inverse ratio of heights})}$$

$$= \sqrt{(3:2)(8:3)} : \sqrt{4:1} = 2:1.$$

Illustration 30: The volumes of two cones are in the ratio 3:2 and their heights in the ratio 3:8. Find out the ratio of their radii.

Solution: Ratio of radii

$$= \sqrt{(\text{ratio of volumes})(\text{inverse ratio of heights})}$$

$$= \sqrt{(3:2)(8:3)} = \sqrt{4:1} = 2:1.$$

(vi) If the ratio of heights and the ratio of diameters (or radii) of two right circular cones (or cylinders) are given, then

Ratio of volumes = (ratio of radii)^2 × (ratio of heights).

Illustration 31: The heights of two cones are in the ratio of 5:3 and their radii is in the ratio 2:3. Find out the ratio of their volumes.

Solution: Ratio of volumes

= (ratio of radii)^2 × (ratio of heights)

= $(2:3)^2 \times (5:3)$

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

(vii) If the ratio of radii (or diameter) and the ratio of volumes of two right circular cones are given, then

ratio of heights

= (inverse ratio of radii)^2 (ratio of volumes).

Illustration 32: The volumes of two cones are in the ratio of 1:4 and their diameters are in the ratio of 4:5. Find out the ratio of their heights.

Solution: Ratio of heights

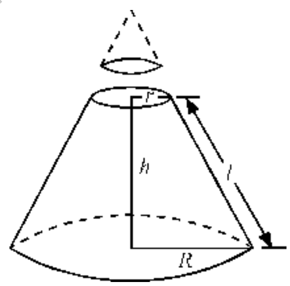
= (inverse ratio of diameters)^2 × (ratio of volumes)

$$= \left(\frac{1}{4} : \frac{1}{5}\right)^2 (1:4) = (5:4)^2 (1:4)$$

$$= \frac{25}{16} \times \frac{1}{4} = 25:64.$$

Frustum of a Right Circular Cone

A cone with some of its top portion cut off is called, the *frustum* of the original cone.



If R = Radius of the base of frustum
r = Radius of the top of the frustum
h = Height of the frustum
l = Slant height of the frustum, then

(a) Slant height = $\sqrt{h^2 + (R - r)^2}$ units

(b) Area of the curved surface = $\pi (R + r) l$ sq. units

(c) Total surface area of the frustum = $\pi [(R^2 + r^2) + l (R + r)]$ sq. units

(d) Volume of the frustum = $\frac{\pi h}{3} (R^2 + r^2 + Rr)$ cu units.

Illustration 33: A reservoir is in the shape of a frustum of a right circular cone. It is 8 m across at the top and 4 m across the bottom. It is 6 m deep. Find out the area of its curved surface, total surface area and also its volume.

Solution: Here, $R = 4$, $r = 2$ and $h = 6$.

∴ Slant height (l) = $\sqrt{h^2 + (R - r)^2}$

$$= \sqrt{(6)^2 + (4-2)^2} = \sqrt{40}.$$

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$\therefore$ Area of the curved surface

$= \pi (R + r) l$

$= \frac{22}{7}(4+2)\sqrt{40}$

$= 18.8 \times 6.3 = 118.4$ m

Total surface area $= \pi [(R^2 + r^2) + l (R + r)]$

$= \frac{22}{7}[(4^2+2^2)+\sqrt{40}\,(4+2)]$

$= \frac{22}{7}(20+6\sqrt{40}) = 181.6 \text{ m}^2$

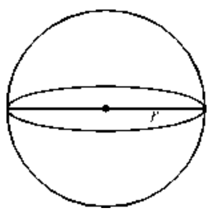
Volume of the frustum $= \frac{\pi h}{3}(R^2+r^2+Rr)$

$= \frac{22}{7}\times\frac{6}{3}(4^2+2^2+4\times 2)$

$= \frac{44}{7}(20+4+8) = 176 \text{ m}^3$.

Sphere

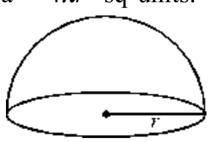
A *sphere* is the solid figure formed by revolving a semi-circle on its diameter.



The mid-point of the diameter is called, centre of the sphere, and the radius of the semi-circle is called, the radius of the sphere.
If r = radius of the spheres, then

(i) Volume of sphere $= \frac{4}{3}\pi r^3$ cubic units

(ii) Surface area $= 4\pi r^2$ sq units.



(iii) Volume of hemisphere $= \frac{2}{3}\pi r^2$ cubic units

(iv) Area of curved surface $= 2\pi r^2$ sq units of hemisphere

(v) Total surface area of hemisphere $= 3\pi r^2$ sq units.

Illustration 34: Diameter of a sphere is 28 cm. Find out its surface area and volume.

Solution: Radius of the sphere $(r) = \frac{28}{2} = 14$ cm.

Surface area $= 4\pi r^2 = 4 \times \frac{22}{7}\times 14\times 14$

$= 2464 \text{ cm}^2$.

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

$= \frac{4}{3}\times\frac{22}{7}\times 14\times 14\times 14$

$= 11498.6 \text{ cm}^3$.

Illustration 35: Find out the volume, curved surface area and total surface area of a hemisphere of radius 21 cm.

Solution: Volume of the hemisphere

$= \frac{2}{3}\pi r^3 = \frac{2}{3}\times\frac{22}{7}\times 21\times 21\times 21 = 19494 \text{ cm}^3$.

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

$= 2 \times \frac{22}{7}\times 21\times 21$

$= 2772 \text{ cm}^2$.

Total surface area $= 3\pi r^2$

$= 3 \times \frac{22}{7}\times 21\times 21$

$= 4158 \text{ cm}^2$.

(vi) For two spheres

(a) (Ratio of radii)^2 = Ratio of surface areas
(b) (Ratio of radii)^3 = Ratio of volumes
(c) (Ratio of surface areas)^3
= (Ratio of volumes)^2.

Illustration 36: The radii of two spheres are in the ratio of 2:3. What is the ratio of their surface areas?

Solution: Ratio of surface areas = (ratio of radii)^2

$= (2:3)^2 = 4:9$.

Illustration 37: The surface areas of two spheres are in the ratio 1:2. Find out the ratio of their volumes.

Solution: We have,

(Ratio of surface areas)^3 = (Ratio of volumes)^2

$\Rightarrow$ $(1:2)^3$ = (Ratio of volumes)^2

$\therefore$ Ratio of volumes $= \sqrt{1:8} = 1:2\sqrt{2}$.

Illustration 38: The radii of two spheres are in the ratio of 2:45. Find out the ratio of their volumes.

Solution: Ratio of volumes = (Ratio of radii)^3

$= (2:5)^3 = 8:125$.

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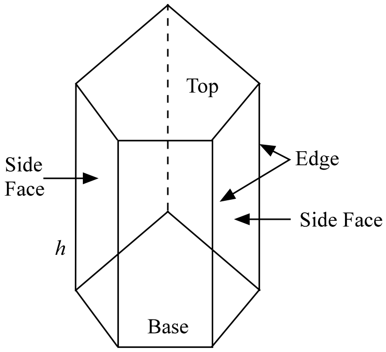
Prism

A solid having top and bottom faces identical and side faces rectangular is a prism.



In a prism with a base of n sides;
Number of vertices = $2n$
and Number of faces = $n + 2$.
Volume of the prism = area of base × height
Lateral surface area = perimeter of base × height
Total surface area = 2 × Base area + Lateral Surface area.

Illustration 39: Find out the volume and the total surface area of a triangular prism whose height is 30 m and the sides of whose base are 21 m, 20 m and 13 m, respectively.

Solution: Perimeter of base = 21 + 20 + 13 = 54 m.
height = 30 m.

$$\text{Area of base} = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{27(27-21)(27-20)(27-13)}$$
$$= \sqrt{27\times 6\times 7\times 14} = 126 \text{ m}^2.$$

$\therefore$ Volume of the prism = area of base × height = 126 × 54 = 6804 m^3.

Also, surface area of the prism
= 2 × Base area + lateral surface area
= 2 Base area + perimeter of base × height
= 2 × 126 + 54 × 30 = 1872 m^2.

SOLIDS INSCRIBED/CIRCUMSCRIBING OTHER SOLIDS

> **1.** If a largest possible sphere is circumscribed by a cube of edge 'a' cm, then the radius of the sphere = $\frac{a}{2}$.

Illustration 40: Find out the volume of largest possible sphere circumscribed by a cube of edge 8 cm.

Solution: Radius of the sphere = $\frac{a}{2} = \frac{8}{2}$ = 4 cm.

$$\therefore \text{ Volume of the sphere} = \frac{4}{3}\pi r^3$$
$$= \frac{4}{3}\times\frac{22}{7}\times 4\times 4\times 4$$
$$= 26.81 \text{ cm}^3.$$

> **2.** If a largest possible cube is inscribed in a sphere of radius 'a' cm, then the edge of the cube $= \frac{2a}{\sqrt{3}}$.

Illustration 41: Find out the surface area of largest possible cube inscribed in a sphere of radius 4 cm.

Solution: Edge of the cube $\frac{2a}{\sqrt{3}} = \frac{2\times 4}{\sqrt{3}} = \frac{8}{\sqrt{3}}$.

$$\therefore \text{ Surface area of the cube} = 6\ (\text{edge})^2$$
$$= 6\times\frac{64}{3}$$
$$= 128 \text{ cm}^2.$$

> **3.** If a largest possible sphere is inscribed in a cylinder of radius 'a' cm and height 'h' cm, then
>
> $$\text{radius of the sphere} = \begin{cases} a \text{ for } h > a \\ \frac{h}{2} \text{ for } a > h \end{cases}$$

Illustration 42: Find out the surface area of largest possible sphere inscribed in a cylinder of radius 14 cm and height 17 cm.

Solution: Radius of the sphere = 14 cm ($\because$ $h > a$)

$$\therefore \text{ Surface area of sphere} = 4\pi r^2$$
$$= 4\times\frac{22}{7}\times 14\times 14$$
$$= 2464 \text{ cm}^2.$$

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4. If a largest possible sphere is inscribed in a cone of radius 'a' cm and slant height equal to the diameter of the base, then radius of the sphere $= \frac{a}{\sqrt{3}}$.

Illustration 43: Find out the surface area of largest possible sphere inscribed in a cone of radius 21 cm and slant height equal to the diameter of the base.

Solution: Radius of the sphere $= \frac{a}{\sqrt{3}} = \frac{21}{\sqrt{3}}$ cm.

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

$$= 4 \times \frac{22}{7} \times \frac{21}{\sqrt{3}} \times \frac{21}{\sqrt{3}}$$

$$= 1848 \text{ cm}^2.$$

5. If a largest possible cone is inscribed in a cylinder of radius 'a' cm and height 'h' cm, then radius of the cone $= a$ and height $= h$.

Illustration 44: Find out the volume of largest possible cone inscribed in a cylinder of radius 6 cm and height 14 cm.

Solution: Radius of the cone (r) = 6 cm.
and height of the cone (h) = 14 cm.

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

$$= \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 14$$

$$= 528 \text{ cm}^2.$$

6. If a largest possible cube is inscribed in a hemisphere of radius 'a' cm, then the edge of the cube $= a\sqrt{\frac{2}{3}}$.

Illustration 45: Find out the length of the diagonal of largest possible cube inscribed in a hemisphere of radius $4\sqrt{2}$ cm.

Solution: Edge of the cube $= a\sqrt{\frac{2}{3}} = 4\sqrt{2} \times \sqrt{\frac{2}{3}} = \frac{8}{\sqrt{3}}$ cm.

$\therefore$ Diagonal of the cube $= \sqrt{3}$ (edge)

$$= \sqrt{3} \times \frac{8}{\sqrt{3}} = 8 \text{ cm}.$$

SOME USEFUL SHORT-CUT METHODS

1. If all three measuring dimensions of a sphere, cuboid, cube, cylinder or cone are increased or decreased by $x\%$, $y\%$ and $z\%$ respectively, then the volume of the figure will increase or decrease by

$$\left(x + y + z + \frac{xy + yz + zx}{100} + \frac{xyz}{100^2}\right)\%$$

For cuboid, the three measuring dimensions are length, breadth and height.
For cube, all three measuring dimensions are equal, i.e., $x = y = z$.
For sphere also, (or diameter) all three measuring dimensions are equal and is given by radius, i.e., $x = y = z = r$.
For cylinder or a cone two measuring dimensions are equal to radius and third measuring dimension is height
i.e., $x = y = r$ and $z = h$.

Illustration 46: The length, breadth and height of a cuboid are increased by 5%, 10% and 20%, respectively. Find out the percentage increase in its volume.

Solution: Here, $x = 5$, $y = 10$ and $z = 20$.

$\therefore$ Percentage increase in volume

$$= \left[x + y + z + \frac{xy + xz + yz}{100} + \frac{xyz}{(100)^2}\right]\%$$

$$= \left[5 + 10 + 20 + \frac{(5\times10) + (5\times20) + (10\times20)}{100} + \frac{5\times10\times20}{(100)^2}\right]\%$$

$$= \left(35 + \frac{350}{100} + \frac{1000}{(100)^2}\right)$$

$$= (35 + 3.5 + 0.1)\%$$

$$= 38.6\%$$

Illustration 47: The sides of a cube are decreased by 10% each. Find out the percentage change in its volume.

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Solution: Here, $x = y = z$.

$\therefore$ Percentage change in volume

$$= \left[3x + \frac{3x^2}{100} + \frac{x^3}{(100)^2}\right]\%$$

$$= \left[3(-10) + \frac{3(-10)^2}{100} + \frac{(-10)^3}{(100)^2}\right]\%$$

$$= (-30 + 3 - 0.1)\% = -27.1\%$$

–ve sign indicates decrease in volume, that is, there is a decrease in volume by 27.1%

Illustration 48: The diameter of a sphere is increased by 20%. What is the percentage increase in its volume?

Solution: Percentage increase in volume

$$= \left[3x + \frac{3x^2}{100} + \frac{x^3}{(100)^2}\right]\% \quad [\text{Here, } x = y = z]$$

$$= \left[3 \times 20 + \frac{3(20)^2}{100} + \frac{(20)^3}{(100)^2}\right]\%$$

$$= (60 + 12 + 0.8)\% = 72.8\%$$

Illustration 49: The radius of a right circular cylinder is decreased by 5%, but its height is increased by 10%. What is the percentage change in its volume?

Solution: Here, $x = y = -15$ and $z = 10$.

$\therefore$ Percentage change in volume

$$= \left[-5 - 5 + 10 + \frac{(-5)(-5) + (-5)(10) + (-5)(10)}{100} + \frac{(-5)(-5)(10)}{(100)^2}\right]\%$$

$$= (0 - 0.75 + 0.025)\% = -0.725\%$$

Therefore, volume decrease by 0.725%

Illustration 50: Each of the radius and the height of a cone is increased by 25%. Find out the percentage increase in volume.

Solution: Here, $x = y = 25$ and $z = 25$.

$\therefore$ Percentage increase in volume

$$= \left[25 + 25 + 25 + \frac{25 \times 25 + 25 \times 25 \times 25 \times 25}{100} + \frac{25 \times 25 \times 25}{(100)^2}\right]\%$$

$$= (75 + 18.75 + 1.56)\% = 95.3\%$$

2. If the two measuring dimensions which are included in the surface area of a sphere, cuboid, cube, cylinder or cone are increased or decreased by x% and y%, then the surface area of the figure will increase or decrease by

$$\left(x + y + \frac{xy}{100}\right)\%$$

Note that in case of percentage increase, values of x, y and z are positive, and in case of percentage decrease, values of x, y and z are negative.

Illustration 51: Each edge of a cube is increased by 20%. What is the percentage increase in its surface area?

Solution: Here, $x = y = 20$.

$\therefore$ Percentage increase in surface area

$$= \left(x + y + \frac{xy}{100}\right)\%$$

$$= \left(20 + 20 + \frac{20 \times 20}{100}\right)\%$$

$$= (40 + 4)\% = 44\%$$

Illustration 52: The radius of a hemisphere is decreased by 10%. Find out the percentage change in its surface area.

Solution: Here, $x = y = -10$.

$\therefore$ Percentage change in surface area

$$= \left(x + y + \frac{xy}{100}\right)\%$$

$$= \left(-10 - 10 + \frac{(-10)\,(-10)}{100}\right)\%$$

$$= (-20 + 1)\% = -19\%$$

Therefore, surface area of hemisphere decreases by 19%

Illustration 53: The radius of a right circular cone is increased by 25% and slant height is decreased by 30%. Find out the percentage change in curved surface area of the cone.

Solution: Here, $x = 25$ and $y = -30$.

$\therefore$ Percentage change in curved surface area

$$= \left(x + y + \frac{xy}{100}\right)\%$$

$$= \left[25 - 30 + \frac{(25)(-30)}{100}\right]\%$$

$$= (-5 - 7.5)\% = -12.5\%$$

Therefore, curved surface area decreases by 12.5%

Illustration 54: The radius and height of a cylinder are increased by 10% and 20%, respectively. Find out the percentage increase in its surface area.

Solution: Here, $x = 10$ and $y = 20$.

$\therefore$ Percentage increase in surface area

$$= \left(x + y + \frac{xy}{100}\right)\%$$

$$= \left(10 + 20 + \frac{10 \times 20}{100}\right)\% = 32\%$$

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> **3.** If a sphere of radius R is melted to form smaller spheres each of radius r, then
>
> The number of smaller spheres
> $$= \frac{\text{Volume of the bigger sphere}}{\text{Volume of the smaller sphere}}$$
> $$= \left(\frac{R}{r}\right)^3.$$

Illustration 55: Find out the number of lead balls of radius 1 cm each that can be made from a sphere of radius 4 cm.

Solution: Number of lead balls = $\left(\frac{R}{r}\right)^3 = \left(\frac{4}{1}\right)^3 = 64.$

> **4.** If by melting n spheres, each of radius r, a big sphere is made, then
>
> Radius of the big sphere = $r \cdot \sqrt[3]{n}$.

Illustration 56: If by melting 8 spheres, each of radius 5 cm, a big sphere is made, what will be the radius of the big sphere?

Solution: Radius of the big sphere = $r \cdot \sqrt[3]{n}$

$$= 5.\sqrt[3]{8} = 5.2 = 19 \text{ cm}.$$

> **5.** If a cylinder is melted to form smaller spheres each of radius r, then
>
> The number of small spheres = $\frac{\text{Volume of cylinder}}{\text{Volume of 1 sphere}}$.

Illustration 57: How many bullets can be made out of a loaded cylinder 24 cm high and 5 cm diameter, each bullet being 2 cm in diameter?

Solution: Number of bullets = $\frac{\text{Volume of cylinder}}{\text{Volume of 1 sphere}}$.

$$= \frac{\pi \times \frac{5}{2} \times \frac{5}{2} \times 24}{\frac{4}{3} \times \pi \times 1 \times 1 \times 1} = 450.$$

> **6.** If a sphere of radius r is melted and a cone of height h is made, then
>
> Radius of the cone = $2 \times \sqrt{\frac{r^3}{h}}$.
>
> or,
>
> If a cone of height h is melted and a sphere of radius r is made, then
>
> Radius of the cone = $2 \times \sqrt{\frac{r^3}{h}}$.

Illustration 58: A solid cone of copper of height 3 cm is melted and a solid sphere of radius 3 cm is made. Then what is the diameter of the base of the cone?

Solution: Radius of the base of the cone

$$= 2 \times \sqrt{\frac{r^3}{h}} = 2 \times \sqrt{\frac{3^3}{3}} = 6$$

$\therefore$ Diameter of the base of the cone = 2×6

= 12 cm.

Illustration 59: If a solid cone of copper of height 2 cm is melted and a solid sphere of radius 2 cm is made, what is the diameter of the base of the cone?

Solution: Radius of the base of the cone

$$= 2 \times \sqrt{\frac{r^3}{h}} . = 2 \times \sqrt{\frac{(2)^3}{2}}$$

$$= 2 \times 2 = 4 \text{ cm}.$$

$\therefore$ Diameter of the base of the cone = $2 \times 4 = 8$ cm.

EXERCISE-1

1. A tank, 16 m long and 23 m wide contains water. How many cubic m of water must be rushed into it to make the surface rise by $16\frac{2}{3}$ cm?

(a) 48 m^3 (b) 40 m^3
(c) 32 m^3 (d) 42 m^3

2. The outer dimensions of a closed box are 12 cm by 10 cm by 8 cm. If the box is made of wood 1 cm thick, find out the capacity of the box.

(a) 360 cm^3 (b) 480 cm^3
(c) 240 cm^3 (d) 560 cm^3

3. A cistren of dimensions 2.4 m × 2.0 m × 1.5 m takes 2 hours 30 minutes to get filled with water. The rate at which water flows into the cistern is:

(a) 0.48000 cu.m/h (b) 800 cu.m/min
(c) 800 cu.m/sec (d) None of these

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4. The area of three adjacent faces of a rectangular box are p, q and r square cm. The volume of the box is given by:

(a) $(p + q + r)$ cm^3 (b) $\sqrt{pqr}$ cm^3
(c) $(pqr)^{1/3}$cm^3 (d) pqr cm^3

5. A reservoir, 30 m long, and 15 m broad, is filled with water. How many gallons of water must be taken out to lower the level of water by 4 m?

(a) 342000 gallons (b) 364200 gallons
(c) 324000 gallons (d) 386400 gallons

6. How many bricks, each measuring 250 cm by 12.5 cm by 7.5 cm, will be required to build a 5 m long, 3 m high and 20 cm thick wall?

(a) 1480 (b) 1280
(c) 1680 (d) 1480

7. Find out the cost of the log of wood measuring 15 $\frac{1}{2}$ m by $2\frac{3}{4}$ m by 1 $\frac{1}{3}$ m at ₹45 per cm^3.

(a) ₹4257.50 (b) ₹4005.00
(c) ₹4207.50 (d) ₹4357.50

8. How many bricks are required to build a 15 m long 3 m high and 50 cm thick wall, if each brick measures 25 cm by 12 cm by 6 cm.

(a) 16500 (b) 14500
(c) 12500 (d) 10500

9. Find the diagonal of a cuboid whose dimensions are 12 m by 10 m by 8 m.

(a) 18 m (b) 17.5 m
(c) 17 m (d) 16.5 m

10. The outer dimensions of a closed wooden box of 1 cm thick are 12 cm by 10 cm by 8 cm. Find out the cost of the wood required to make the box if 1 cm^3 of wood costs ₹3.00.

(a) ₹1440 (b) ₹1640
(c) ₹1840 (d) ₹2040

11. 3 equal cubes are placed adjacently in a row. Find out the ratio of the total surface area of the new cuboid to that of the sum of the surface areas of the three cubes:

(a) 3:5 (b) 4:5
(c) 6:7 (d) 7:9

12. The diagonal of a cubical box is $\sqrt{300}$ cm. Find out the surface area:

(a) $600\sqrt{3}$ cm^2 (b) 600 cm^2
(c) 1200 cm^2 (d) $900\sqrt{3}$ cm^2

13. An iron cube of 10 cm sides is hammered into a rectangular sheet of thickness 0.5 cm. If the sides of the sheet be in the ratio 1:5, the sides (in cm) are:

(a) 110 cm, 50 cm (b) 20 cm, 100 cm
(c) 40 cm, 200 cm (d) None of these

14. The length of a room is 12 m, width 8 m, and height 6 m. How many boxes will it hold if each is allowed 1.5 cubic metre of space?

(a) 864 (b) 506
(c) 384 (d) 436

15. A 3.3 m high room is half as long again as it is wide and its volume is $123\frac{3}{4}$ m^3. Find out its length and breadth.

(a) 7.5 m, 6 m (b) 8 m, 5 m
(c) 7.5 m, 5 m (d) 8.5 m, 5 m

16. A tank 3 m long, 2 m wide and 1.5 m deep is dug in a field 22 m long and 14 m wide. If the earth dug out is evenly spread out over the field, the level of the field will rise by nearly:

(a) 0.299 cm (b) 0.29 mm
(c) 2.98 cm (d) 4.15 cm

17. A school room is to be built to accommodate 70 children, so as to allow 2.2 m^2 of floor and 11 m^3 of space for each child. If the room be 14 m long, what must be its breadth and height?

(a) 12 m, 5,5 m (b) 11 m, 5 m
(c) 13 m, 6 m (d) 11 m, 4 m

18. If 210 m^3 of sand be thrown into a tank 12 m long and 5 m wide, find how much the water will rise?

(a) 3.5 m (b) 4 m
(c) 7 m (d) Data inadequate

19. If the length, breadth and height of a rectangular parallelopiped are in the ratio 6:5:4 and if total surface area is 33,300 m^2, then the length, breadth and height of parallelopiped (in cm) respectively are:

(a) 90, 85, 600 (b) 90, 75, 70
(c) 85, 75, 60 (d) 90, 75, 60

20. A m^3 of metal weighing 90 Kg is rolled into a square bar 9 metre long. An exact cube is cut off from the bar. How much does it weigh?

(a) $5\frac{2}{3}$ Kg (b) $6\frac{1}{3}$ Kg
(c) $3\frac{1}{3}$ Kg (d) $4\frac{2}{3}$ Kg

21. How many cubes, each of surface 24 cm^2, can be made out of a cube of edge measure 1 metre?

(a) 165000 (b) 125000
(c) 180000 (d) 155000

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22. 3 solid cubes whose edges are 6, 8 and 10 cm respectively, are melted and formed into a single cube. If there be no loss of metal in the process, find out the edge of the new cube.

(a) 16 cm (b) 10 cm
(c) 14 cm (d) 12 cm

23. If a cube with its edge 6 cm is melted and smaller cubes with edge 2 cm each are formed, then how many cubesare formed?

(a) 39 (b) 24
(c) 27 (d) 21

24. How many small cubical blocks of side 5 cm can be cut from a cubical block whose each edge measures 20 cm?

(a) 56 (b) 48
(c) 64 (d) 52

25. Surface area of a cube is 600 cm^2. Find out the length of its diagonal.

(a) $15\sqrt{3}$ (b) $12\sqrt{3}$
(c) $10\sqrt{3}$ cm (d) None of these

26. A rectangular tank is 30 m long and 20 m broad. Water is being flown into it through a square pipe of side 5 cm. What is the speed of water if the level of water in the tank rises by 1 m in 8 hours?

(a) 30 Km/h (b) 36 Km/h
(c) 40 Km/h (d) None of these

27. Calculate the number of bricks, each measuring 25 cm × 15 cm × 8 cm, required to construct a wall with its dimension 19 m × 4 m × 5 m, when 10% of its volume is occupied by mortar.

(a) 4000 (b) 8000
(c) 7000 (d) 6000

28. 3 cubes of metal whose edges are in the ratio 3:4:5 are melted into a single cube, the length of whose diagonal is $48\sqrt{3}$ m. Calculate the edges of the three cubes.

(a) 24 m, 32 m, 40 m (b) 40 m, 32 m, 24 m
(c) 30 m, 22 m, 18 m (d) 48 m, 36 m, 24 m

29. A cube of lead with edges measuring 6 cm each is melted and recasted into 27 equal cubes. The length of the edge of the new cube is:

(a) 3 cm (b) 4 cm
(c) 2 cm (d) 1.5 cm

30. The volume of a cube is 729 cm^3. The total surface area of the cube is:

(a) 216 cm^2 (b) 384 cm^2
(c) 486 cm^2 (d) 512 cm^2

31. 2 cubes have volumes in the ratio 1:27. The ratio of the area of the face of one to that of the other is:

(a) 1:2 (b) 1:3
(c) 1:6 (d) 1:9

32. 2 cubes, each of side 12 cm, are joined end-to-end. The surface area of the resulting cuboid is:

(a) 1240 cm^2 (b) 1440 cm^2
(c) 2250 cm^2 (d) 4252 cm^2

33. The perimeter of one face of a cube is 20 cm. Its volume is:

(a) 1009 cm^3 (b) 525 cm^3
(c) 320 cm^3 (d) 125 cm^3

34. A cube of edge 3 cm of iron weighs 12 gm. What is the weight of a similar cube of iron whose edge is 12 cm?

(a) 768 gm (b) 678 gm
(c) 964 gm (d) 864 gm

35. The weight of a solid cube of iron of 1 cm edge is 17 gm. What should be the weight with a similar cube of edge 3 cm?

(a) 449 gm (b) 459 gm
(c) 469 gm (d) 4390 gm

36. A cubic metre of silver weighing 900 Kg is rolled into a 16 m long square bar. Find out the weight of an exact cube cut off from it.

(a) 14 Kg $62\frac{1}{2}$ gm (b) 30 Kg
(c) 10 Kg (d) 7 Kg 50 gm

37. A 4 cm cube is cut into 1 cm cubes. What is the ratio of the surface area of small cubes to that of the large cube?

(a) 1:16 (b) 2:3
(c) 4:1 (d) 6:1

38. A large cube is formed from the material obtained by melting three smaller cubes of 3, 4 and 5 cm side. What is the ratio of the total surface areas of the smaller cubes and the large cube?

(a) 2:1 (b) 3:2
(c) 25:18 (d) 27:20

39. How many small cubes, each of 96 cm^2 surface area, can be formed from the material obtained by melting a larger cube with 384 cm^2 surface area?

(a) 8 (b) 5
(c) 800 (d) 8000

40. A cubical metallic tank whose each edge measures 30 cm, is completely filled with water. If 2,7 litres

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water is taken out of it, what will be the depth of the remaining water in the tank?

(a) 37 cm (b) 27 cm
(c) 17 cm (d) None of these

41. Find out the weight of a hollow cylindrical lead pipe 28 cm long and $\frac{1}{2}$ cm thick. Its internal diameter is 8 cm. $\left(\text{Weight of 1 cm}^3 \text{ of lead is 11.4 g, } \pi = \frac{22}{7}\right)$

(a) 3.762 Kg (b) 4.562 Kg
(c) 7.462 Kg (d) 6.762 Kg

42. Volume of the cylinder is 1650 m^3. whereas the surface area of its base is $78\frac{4}{7}$ m^2. Find out the height of the cylinder.

(a) 2.1 m (b) 7.5 m
(c) 21 m (d) 14 m

43. 1496 cm^3 of a metal is used to cast a pipe of length 28 cm. If the internal radius of the pipe is 8 cm, then the outer radius of the pipe is:

(a) 7 cm (b) 9 cm
(c) 10 cm (d) 12 cm

44. The base of a of 10 cm high solid cylinder is a semi-circle of radius 7 cm. Its total surface (in cm^2) is $\left(\text{Use } \pi = \frac{22}{7}\right)$

(a) 154 (b) 176
(c) 514 (d) None of these

45. A sphere is melted to form a cylinder whose height is $4\frac{1}{2}$ times its radius; What is the ratio of radii of sphere to the cylinder?

(a) 3:2 (b) 4:3
(c) 3:5 (d) 2:3

46. The radius of a cylinder is the same as that of a sphere. Their volumes are equal. The height of the cylinder is:

(a) 4/3 times its radius. (b)2/3 times its radius.
(c) equal to its radius. (d)equal to its diameter.

47. A 12 m deep well with internal diameter 3.5 m is dug up. The earth from it is spread evenly to form a platform 10.5 m by 8.8 m. Determine the height of the platform.

(a) 2.25 m (b) 3.25 m
(c) 1.25 m (d) 4.25 m

48. The curved surface of a well is 264 sq m and its capacity is 924 m^3. What is the diameter and the depth of the well?

(a) 8 m (b) 9 m
(c) 4.5 m (d) 6 m

49. The sum of the radius of the base and the height of a solid cylinder is 37 m. If the total surface area of the cylinder be 1628 m^2, find out the volume:

(a) 4620 m^3 (b) 4630 m^3
(c) 4520 m^3 (d) 4830 m^3

50. A brick measures 20 cm by 10 cm by $7\frac{1}{2}$ cm. How many bricks will be required for constructing a 25 m long, 2 m high and $\frac{3}{4}$ m thick wall?

(a) 25000 (b) 35000
(c) 20000 (d) 45000

51. The height of a right circular cylinder is 6 m. 3 times the sum of the areas of its two circular faces is twice the area of its curved surface. The radius of the base is:

(a) 4 m (b) 2 m
(c) 6 m (d) 1.5 m

52. The radius of the cylinder is made twice as large. How should the height be changed so that the volume remains the same?

(a) $\frac{1}{2}$ × height of two cylinders

(b) $\frac{1}{4}$ × height of original cylinder

(c) $\frac{1}{4}$ πr^2

(d) None of these

53. A right cylinder and a right circular cone have the same radius and the same volume. The ratio of the height of the cylinder to that of the cone is:

(a) 3:5 (b) 2:5
(c) 3:1 (d) 1:3

54. 2 cans have the same height equal to 21 m. One can is cylindrical, the diameter of whose base is 10 cm. The other can has square base of side 10 cm. What is the difference in between their capacities?

(a) 350 cm^2 (b) 450 cm^3
(c) 250 cm^2 (d) None of these

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55. A roller is 120 cm long and has diameter 84 cm. If it takes 500 complete revolutions to level a play ground, then determine the cost of levelling at the rate of 30 paise per m^2. $\left(\text{Use } \pi = \dfrac{22}{7}\right)$

(a) ₹475.40 (b) ₹375.45
(c) ₹375.20 (d) ₹475.20

56. The circumference of one end of a frustum of a right circular cone is 48 cm and of the other end is 34 cm. If the height of the frustrum is 10 cm, its volume (in cm^3) is:

(a) 5400 (b) 1350
(c) 2700 (d) 4050

57. Find out the amount of concrete required to erect a concrete pillar whose circular base will have a perimeter 8.8 m and whose curved surface is 17.6 m. $\left(\pi = \dfrac{22}{7}\right)$

(a) $12\dfrac{4}{25}$ m^3 (b) $12\dfrac{3}{25}$ m^3
(c) $12\dfrac{1}{2}$ m^3 (d) $12\dfrac{8}{25}$ m^3

58. Sum of the length, width and depth of a cuboid is s and its diagonal is d. Its surface area is:

(a) s^2 (b) d^2
(c) $s^2 - d^2$ (b) $s^2 + d^2$

59. A cylindrical tower is 5 m in diameter and 14 m high. The cost of white washing its curved surface at 50 paise per m^2 is:

(a) ₹90 (b) ₹97
(c) ₹100 (d) ₹110

60. A solid piece of iron of dimensions $49 \times 33 \times 24$ cm is moulded into a sphere, The radius of the sphere is:

(a) 35 cm (b) 21 cm
(c) 29 cm (d) None of these

61. How many coins, 2 mm thick and 1.5 cm in diameter, should be melted in order to form a right circular cylinder its base diameter 6 cm and height 8 cm?

(a) 640 (b) 540
(c) 740 (d) 840

62. A hemisphere is made of lead. Its of radius is 6 cm; It cast into a right circular cone of 75 cm height. The radius of the base of the cone is:

(a) 1.4 cm (b) 2.4 cm
(c) 1.6 cm (d) 3.2 cm

63. A solid cylinder has a total surface area of 231 cm^2. Its curved surface area is (2/3) of the total surface area. Find out the volume of the cylinder.

(a) 270 cm^3 (b) 269.5 cm^3
(c) 256.5 cm^3 (d) 289.5 cm^3

64. It is required to design a circular pipe such that water flowing through it at a speed of 7 m per min fills a tank of capacity 440 cubic m in 10 min. The inner radius of the pipe should be:

(a) 2 m (b) $\sqrt{2}$ m
(c) $\dfrac{1}{2}$ m (d) $\dfrac{1}{\sqrt{2}}$ m

65. From a solid right circular cylinder with height 10 cm and radius of the base 6 cm; a right circular cone of the same height and base is removed. The volume (in cm^3) of the remaining solid is:

(a) 377 (b) 754.3
(c) 1131 (d) None of these

66. The radii of two cylinders are in the ratio 2:3. The ratio their height is 5:3. The ratio of their volume is:

(a) 20:27 (b) 10:9
(c) 18:13 (d) 9:20

67. The capacity of a tank, in the form of a cylinder, is 6160 m^3. If the diameter of its base is 28 m, find out the cost of painting its inner curved surface at the rate of ₹2.8 per m^2. $\left(\text{Use } \pi = \dfrac{22}{7}\right)$

(a) 2464 (b) 2664
(c) 3064 (d) 2864

68. The sum of the radius of the base and the height of a solid cylinder is 37 m. If the total surface area of the solid cylinder is 1628 m^2, then the circumference of its base and the volume of the cylinder are:

(a) 68 m; 7875 m^3 (b) 52 m; 5825 m^3
(c) 44 m; 4620 m^3 (d) 30 m; 3859 m^3

69. A rectangular piece of paper is 22 cm long and 10 cm wide. A cylinder is formed by rolling the paper along its length. The volume of the cylinder is:

(a) 225π cm^3 (b) 385 cm^3
(c) 25π cm^3 (d) None of these

70. The ratio of total surface area to lateral surface area of a cylinder whose radius is 80 cm and height 20 cm, is:

(a) 2:1 (b) 3:1
(c) 4:1 (d) 5:1

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71. A right cylindrical vessel is full with water. How many right cones having the same diameter and height as those of right cylinder will be needed to store that water?

(a) 2 (b) 3
(c) 4 (d) 5

72. A cylindrical bucket is 72 cm high and 29 cm in diameter and is full of water. This water is emptied in a rectangular tank whose length and breadth are 66 cm and 28 cm, respectively. What will be the height of the water level in the tank?

(a) 36 cm (b) 48 cm
(c) 24 cm (d) 22 cm

73. A cylindrical iron rod is 70 cm long. The diameter of its end portion is 2 cm. What is its weight, reckoning a cm^3 of iron to weigh 10 grams?

(a) 4 Kg (b) 4.2 Kg
(c) 2.2 Kg (d) Data inadequate

74. If the radius of a cylinder is doubled and the height is halved, then what would be ratio between the new curved surface area and the previous curved surface area of the cylinder:

(a) 1:1 (b) 2:1
(c) 3:2 (d) 2:3

75. A cylindrical jar of diameter 24 cm contains water to a height of 30 cm. A spherical steel ball is dropped into the jar and the level of the water rises by 67.5 mm. The diameter of the ball is:

(a) 16 cm (b) 15 cm
(c) 20 cm (d) 18 cm

76. The material of a solid cone is converted into the shape of solid cylinder of equal radius. If the height of the cylinder is 5 cm, then what is the height of the cone?

(a) 25 cm (b) 15 cm
(c) 20 cm (d) 10 cm

77. The volume of solid cylinder whose diameter of the base is 14 mm and length 25 mm is 3850 mm^3. If length of the cylinder is doubled, but the diameter is halved, then what will be the volume of the resulting cylinder?

(a) 1172 mm^3 (b) 1925 mm^3
(c) 3850 mm^3 (d) 7700 mm^3
(e) None of these

78. A monument has 50 cylindrical pillars each of diameter 50 cm and height 4 m. What will be the labour charges for cleaning these pillars at the rate of 50 paise per m^2? (Use $\pi = 3.14$):

(a) ₹237 (b) ₹257
(c) ₹157 (d) ₹353

79. The radius of a cylinder is made twice large. How should the height be changed, so that its volume remains unchanged?

(a) $\frac{1}{4}$ of original (b) $\frac{1}{3}$ of original

(c) $\frac{1}{2}$ of original (d) $\frac{1}{8}$ of original

80. A spherical ball of lead, 3 cm in diameter, is melted and re-cast into three spherical balls. The diameter of 2 of these are 1.5 cm and 2 cm, respectively. The diameter of the third ball is:

(a) 2.66 cm (b) 2.5 cm
(c) 3 cm (d) 3.5 cm

81. A cone and a cylinder having the same area of the base have also the same area of curved surfaces. If the height of cylinder be 2 m, find out the slant height of the cone:

(a) 3 m (b) 3.5 m
(c) 4.5 m (d) 4 m

82. The radii of a cylinder and a cone are equal. If the height of the cylinder is equal to the slant height of the cone then the ratio of the curved surfaces of the cylinder and the cone is:

(a) 1:1 (b) 2:1
(c) 3:1 (d) 4:1

83. From a cubical block of wood of side 1 m, a cylinder of the largest possible volume is curved out. The volume (in m^3) of the remaining wood is:

(a) $\frac{3}{14}$ (b) $\frac{5}{14}$

(c) $\frac{1}{2}$ (d) $\frac{2}{7}$

84. The radius of the base of a solid cylinder is r cm and its height is 3 cm. It is re-casted into a cone of same radius, the height of the cone will be:

(a) 3 cm (b) 6 cm
(c) 9 cm (d) 27 cm

85. 2 cm of rain has fallen on a Km^2 of land. Assuming that 50% of the raindrops could have been collected and contained in a pool having a 100 m × 10 m base, by what level would the water level in the pool have increased?

(a) 15 m (b) 20 m
(c) 10 m (d) 25 m

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86. The perpendicular height of a conical tent is $4\frac{2}{3}$ m and the diameter of its base is 6 m. If 11 persons can sleep in this tent, find how many average cu m of air each person gets?
(a) 2 cu m (b) 4 cu m
(c) 6 cu m (d) 8 cu m

87. The circumference of the base of a 9 m high conical tent is 44 m. The volume of the air contained in it is:
(a) 462 m^3 (b) 452 m^3
(c) 472 m^3 (d) 512 m^3

88. A conical vessel of base radius 2 cm and height 3 cm is filled with kerosene. This liquid leaks through a hole in the bottom and collects in a cylindrical jar of radius 2 cm. The kerosene level in the jar is:
(a) 1.5 cm (b) π cm
(c) 1 cm (d) 3 cm

89. A hollow cylinder of height 3 cm, is re-casted into a solid cylinder. If the external and internal radii of the hollow cylinder are 4.3 cm and 1.1 cm, respectively. What will be the radius of the solid cylinder?
(a) 2.8 cm (b) 2.4 cm
(c) 3.2 cm (d) 4.8 cm

90. A solid consists of a circular cylinder with an exact fitting right circular cone placed on the top. The height of the cone is h. If the total volume of the solid is three times the volume of the cone, then the height of the cylinder is:
(a) $2h$ (b) $4h$
(c) $\frac{2h}{3}$ (d) $\frac{3h}{3}$

91. A well of 11.2 m diameter is dug 8 m deep. The earth taken out has been spread all around it to a width of 7 cm to form a circular embankment. Find out the height of the embankment.
(a) 304.8 m^2 (b) 400.4 m^2
(c) 408.4 m^2 (d) 412.4 m^2

92. The curved surface of a circular cylinder of height h and the slant surface of the cone of slant height '$2h$' having the same circular base are in the ratio of:
(a) 1:1 (b) 1:2
(c) 3:2 (d) 1:3

93. The material of a cone is converted into the shape of a cylinder of equal radius. If the height of the cylinder is 5 cm, the height of the cone is:
(a) 10 cm (b) 15 cm
(c) 18 cm (d) 24 cm

94. A right circular cone is exactly fitted inside a cube in such a way that the edges of the base of the cone are touching the edges of one of the faces of the cube and the vertex is on the opposite face of the cube. If the volume of the cube is 343 c.c, then what approximately is the volume of the cone?
(a) 90 c.c. (b) 75 c.c.
(c) 80 c.c. (d) 85 c.c.

95. A solid cone is 25 cm high and the radius of its base is 50 cm. It is melted and re-cast into a solid sphere. Determine the surface area of the sphere.
(a) 8757.28 cm^2 (b) 5877.42 cm^2
(c) 7857.14 cm^2 (d) None of these

96. The radius and height of right circular cone are in the ratio 5:12. If its volume is $314\frac{3}{7}m^3$. Find out the radius of the cone.
(a) 5 m (b) 8 m
(c) 12 m (d) 6 m

97. A cone, a hemisphere and a cylinder stand on equal bases and have the same height. The ratio of their volumes are:
(a) 1:2:2 (b) 1:2:3
(c) 1:2:4 (d) 2:3:4

98. Find out the length of the canvas 2 m in width required to make a conical tent 12 m in diameter and 6.3 m in slant height:
(a) 118.8 m (b) 62.4 m
(c) 59.4 m (d) 112.4 m

99. The radius of a cylinder is doubled and the height is halved, what is the ratio between the new volume and the previous volume?
(a) 3:1 (b) 2:3
(c) 2:1 (d) 1:3

100. A circus tent is cylindrical to a height of 3 m and conical above it. If its diameter is 105 m and slant height of the conical portion is 53 m, then calculate the length of the canvas 5 m wide to make the tent.
(a) 1857 m (b) 1647 m
(c) 1947 m (d) 1847 m

101. If base radius of a cone is increased by 20% and its slant height is doubled, then by how much per cent will the area of its curved surface be increased?
(a) 140% (b) 160%
(c) 130% (d) 180%

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102. The radius of the base of conical tent is 5 cm. If the tent is 12 m high, then area of the canvas required in making the tent is:

(a) 60 π m^2 (b) 300 π m^2
(c) 90 π m^2 (d) None of these

103. A cone of height 7 cm and base radius 3 cm is carved from a rectangular block of wood 10 cm × 5 cm × 2 cm. The percentage % wood wasted is:

(a) 34% (b) 46%
(c) 54% (d) 66%

104. The diameter and slant height of a conical tomb are 28 m and 50 m, respectively. The cost of white washing its curved surface at the rate of 80 paise per m^2 is:

(a) ₹2640 (b) ₹1760
(c) ₹264 (d) ₹176
(e) None of these

105. A rectangular sheet of area 264 cm^2 and width 11 cm is rolled along its breadth to make a hollow cylinder. The volume of the cylinder is:

(a) 231 c.c. (b) 230 c.c.
(c) 235 c.c. (d) 234 c.c.

106. A cylinder and a cone have their heights in the ratio 2:3 and the radii of their bases in the ratio 3:4. Find out the ratio of their volumes.

(a) 1:9 (b) 2:9
(c) 9:8 (d) 1:8

107. If the height of a cone is doubled, then its volume is increased by:

(a) 100% (b) 200%
(c) 300% (d) 400%

108. 3 cubes of side 3, 4 and 5, respectively, are melted to form into new cube. The side of the new cube is:

(a) 5 cm (b) 6 cm
(c) 6.5 cm (d) 7 cm

109. The height and base radius of a cone are each increased by 100%. The volume of the cone now becomes:

(a) double the original.
(b) 4 times the original.
(c) 3 times the original.
(d) 8 times the original.

110. If the radius of a sphere is doubled, then its volume is increased by:

(a) 100% (b) 200%
(c) 700% (d) 800%

111. The diameter of a sphere is 6 cm. It is melted and drawn into a wire of diameter 0.2 cm. Find out the length of the wire.

(a) 24 m (b) 28 m
(c) 36 m (d) 32 m

112. A cone-shaped circular tent is 9 m high and the circumference of its circular base is 44 m. How much air is contained in the tent? $\left(\text{Use } \pi = \frac{22}{7}\right)$

(a) 362 m^3 (b) 462 m^3
(c) 562 m^3 (d) 662 m^3

113. If the radius of a sphere is doubled, then its surface area is increased by:

(a) 100% (b) 200%
(c) 300% (d) 50%

114. The height of a cylinder is decreased by 8%, keeping its radius unchanged. What is the percentage change in its volume?

(a) 8% increase (b) 12% decrease
(c) 8% decrease (d) None of these

115. The radius of a cylinder is increased by 20%, keeping its height unchanged. What is the percentage increase in its volume?

(a) 33% (b) 44%
(c) 22% (d) None of these

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EXERCISE-2
(BASED ON MEMORY)

1. A hemisphere and a cone have equal bases. If their heights are also equal, then the ratio of their curved surfaces will be:

(a) $1:\sqrt{2}$ (b) $\sqrt{2}:1$
(c) 1:2 (d) 2:1

[SSC (GL) Prel. Examination, 2005]

2. The curved surface of a cylindrical pillar is 264 m^2 and its volume is 924 m^3. The ratio of its diameter to its height is [use $\pi = \frac{22}{7}$]

(a) 7:6 (b) 6:7
(c) 3:7 (d) 7:3

[SSC (GL) Prel. Examination, 2005]

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

(a) 27:20 (b) 20:27
(c) 9:4 (d) 4:9

[SSC (GL) Prel. Examination, 2005]

4. A cuboidal water tank contains 216 litres of water. Its depth is $\frac{1}{3}$ of its length and breadth is $\frac{1}{2}$ of $\frac{1}{3}$ of the difference between the length and the depth. The length of the tank is:

(a) 72 dm (b) 18 dm
(c) 6 dm (d) 2 dm

[SSC (GL) Prel. Examination, 2005]

5. 12 spheres of the same size are made by melting a solid cylinder of 16 cm diameter and 2 cm height. The diameter of each sphere is:

(a) 2 cm (b) 4 cm
(c) 3 cm (d) $\sqrt{3}$ cm

[SSC (GL) Prel. Examination, 2005]

6. A rectangular paper 11 cm by 8 cm can be exactly wrapped to cover the curved surface of a cylinder of height 8 cm. The volume of the cylinder is:

(a) 6 cm^3 (b) 77 cm^3
(c) 88 cm^3 (d) 121 cm^3

[SSC (GL) Prel. Examination, 2000]

7. The volumes of two spheres are in the ratio 8:27. The ratio of their surface areas is:

(a) 4:9 (b) 2:3
(c) 4:5 (d) 5:6

[SSC (GL) Prel. Examination, 2000]

8. How many cubes, each of edge 3 cm, can be cut to form a cube of edge 15 cm?

(a) 25 (b) 27
(c) 125 (d) 144

[SSC (GL) Prel. Examination, 2000]

9. If the volumes of 2 cubes are in the ratio 27:64, then the ratio of their total surface areas is:

(a) 27:64 (b) 3:4
(c) 9:16 (d) 3:8

[SSC (GL) Prel. Examination, 2000]

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

(a) 27:20 (b) 20:27
(c) 9:4 (d) 4:9

[SSC (GL) Prel. Examination, 2000]

11. The slant height of a conical mountain is 2.5 Km and the area of its base is 1.54 Km^2. Find out the height.

(a) 2.2 Km (b) 2.4 Km
(c) 3 Km (d) 3.11 Km

[SSC (GL) Prel. Examination, 2000]

12. A hemisphere and a cone have equal bases. If their heights are also equal, the ratio of their curved surfaces will be:

(a) $1:\sqrt{2}$ (b) $\sqrt{2}:1$
(c) 1:2 (d) 2:1

[SSC (GL) Prel. Examination, 2000]

13. Three solid metallic spheres of diameters 6 cm, 8 cm and 10 cm are melted and recast into a new solid sphere. The diameter of the new sphere is:

(a) 4 cm (b) 6 cm
(c) 8 cm (d) 12 cm

[SSC (GL) Prel. Examination, 2000]

14. The base of a conical tent is 19.2 m in diameter and the height of its vertex is 2.8 m. The area of the canvas required to put up such a tent (in m^2) $\left(\text{taking } \pi = \frac{22}{7}\right)$ is nearly:

(a) 3017.1 (b) 3170
(c) 301.7 (d) 30.17

[SSC (GL) Prel. Examination, 2000]

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15. A cone of height 7 cm and base radius 1 cm is carved from a cuboidal block of wood 10 cm × 5 cm × 2 cm. Assuming $\pi = \frac{22}{7}$, the percentage wood wasted in the process is:

(a) $92\frac{2}{3}\%$ (b) $46\frac{1}{3}\%$
(c) $53\frac{2}{3}\%$ (d) $7\frac{1}{3}\%$

[SSC (GL) Prel. Examination, 2000]

16. Three solid metallic balls of radii 3 cm, 4 cm and 5 cm are melted and mounted into a single solid ball. The radius of the new ball is:

(a) 2 cm (b) 3 cm
(c) 4 cm (d) 6 cm

[SSC (GL) Prel. Examination, 2000]

17. The volume of a cuboid is twice the volume of a cube. If the dimensions of the cuboid are 9 cm, 8 cm and 6 cm the total surface area of the cube is:

(a) 72 cm^2 (b) 216 cm^2
(c) 432 cm^2 (d) 108 cm^2

[SSC (GL) Prel. Examination, 2002]

18. The curved surface of a cylindrical pillar is 264 m^2 and its volume is 924 m^2. Taking $\pi = \frac{22}{7}$, find out the ratio of its diameter to its height:

(a) 7:6 (b) 6:7
(c) 3:7 (d) 7:3

[SSC (GL) Prel. Examination, 2002]

19. A room is 6 m long, 5 m broad and 4 m high. The maximum length of the rod that can be kept in the room is:

(a) $\sqrt{61}$ m (b) $\sqrt{16}$ m
(c) $\sqrt{36}$ m (d) $\sqrt{77}$ m

20. The number of coins of radius 0.75 cm and thickness 0.2 cm to be melted to make a right circular cylinder of height 8 cm and base radius 3 cm is:

(a) 640 (b) 460
(c) 500 (d) 600

[SSC (GL) Prel. Examination, 2002]

21. The area of the base of a right circular cone is 154 cm^2 and its height is 14 cm. Taking $\pi = \frac{22}{7}$, the curved surface of the cone is:

(a) $(154 \times \sqrt{5})$ cm^2 (b) $(154 \times \sqrt{5})$ cm^2
(c) 11 cm^2 (d) 5324 cm^2

[SSC (GL) Prel. Examination, 2002]

22. If the areas of the three adjacent faces of a cuboidal box are 120 cm^2, 72 cm^2 and 60 cm^2, respectively, then find the volume of box:

(a) 7200 cm^3 (b) 720 cm^3
(c) 864 cm^3 (d) $(72)^2$ cm^3

[SSC (GL) Prel. Examination, 2002]

23. If a right circular cone of height 24 cm has a volume of 1232 cm^3, then the area of its curved surface is $\left(\text{Use } \pi = \frac{22}{7}\right)$

(a) 1254 cm^2 (b) 794 cm^2
(c) 550 cm^2 (d) 154 cm^2

[SC (GL) Prel. Examination, 2002]

24. Spheres A and B have their radii 40 cm and 10 cm, respectively. Ratio of surface area of A to the surface area of B is:

(a) 1:16 (b) 4:1
(c) 1:4 (d) 16:1

25. A cylindrical tube, open at both ends, is made of metal. The internal diameter of the tube is 11.2 cm and its length is 21 cm. The metal everywhere is 0.4 cm thick. The volume of the metal is $\left(\text{Use } \pi = \frac{22}{7}\right)$

(a) 316 cm^3 (b) 310 cm^3
(c) 306.24 cm^3 (d) 280.52 cm^3

[SSC (GL) Prel. Examination, 2003]

26. A wooden box measures 20 cm by 12 cm by 10 cm. Thickness of wood is 1 cm. Volume of wood to make the box (in cubic cm) is:

(a) 960 (b) 519
(c) 2400 (d) 1120

[SSC (GL) Prel. Examination, 2003]

27. A 20 cm long hollow cylindrical tube is made of iron and its external and internal diameters are 8 cm and 6 cm, respectively. The volume of iron used in making the tube is $\left(\text{Use } \pi = \frac{22}{7}\right)$

(a) 1760 cm^3 (b) 880 cm^3
(c) 440 cm^3 (d) 220 cm^3

[SSC (GL) Prel. Examination, 2003]

28. The area of a side of a box is 120 cm^2. The area of the other side of the box is 72 cm^2. If the area of the upper surface of the box is 60 cm^2, find the volume of the box.

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(a) 259200 cm^3 (b) 86400 cm^3
(c) 720 cm^3 (d) Cannot be determined
(d) None of these

[BSRB Bangalor PO Examination, 2000]

29. Water is flowing at the rate of 5 Km/h through a pipe of diameter 14 cm into a rectangular tank which is 50 m long, 44 m wide. The time taken, in hours, for the rise in the level of water in the tank to be 7 cm is:

(a) 2 (b) $1\frac{1}{2}$
(c) 3 (d) $2\frac{1}{2}$

[SSC (GL) Examination, 2011]

30. The areas of three consecutive faces of a cuboid are 12 cm^2, 20 cm^2 and 15 cm^2, then the volume (in cm^3) of the cuboid is:

(a) 3600 (b) 100
(c) 80 (d) 60

[SSC (GL) Examination, 2011]

31. Water is flowing at the rate of 3 Km/h through a circular pipe of 20 cm internal diameter into a circular cistern of diameter 10 m and depth 2 m. In how much time will the cistern be filled?

(a) 1 hour (b) 1 hour 40 mins
(c) 1 hours 20 mins (d) 2 hours 40 mins

[SSC (GL) Examination, 2011]

32. Marbles of diameter 1.4 cm are dropped into a cylindrical beaker containing some water and are fully submerged. The diameter of the beaker is 7 cm. Find how many marbles have been dropped in it if the water rises by 5.6 cm.

(a) 50 (b) 150
(c) 250 (d) 350

[SSC (GL) Examination, 2011]

33. A hemisphere and a cone have equal bases. If their heights are also equal, the ratio of their curved surfaces will be:

(a) $1:\sqrt{2}$ (b) $2:\sqrt{2}$
(c) 1:2 (d) 2:1

[SSC (GL) Examination, 2011]

34. If the side of a cube is increased by 100%, its volume is increased by:

(a) 400% (b) 800%
(c) 200% (d) 100%

[UPPCS Examination, 2012]

35. The height of a cone is 30 cm. A small cone is cut off at the top by a plane parallel to the base. If its volume be $\frac{1}{27}$th of the volume of the given cone, at what height above the base is the section made?

(a) 19 cm (b) 20 cm
(c) 12 cm (d) 15 cm

[SSC Examination, 2014]

36. If the surface area of a sphere is 346.5 cm^2, then its radius is $\left[\text{taking } \pi = \frac{22}{7}\right]$

(a) 7 cm (b) 3.25 cm
(c) 5.25 cm (d) 9 cm

[SSC Examination, 2014]

37. The height of the right pyramid whose area of the base is 30 m^2 and volume is 500 m^3, is:

(a) 50 m (b) 60 m
(c) 40 m (d) 20 m

[SSC Examination, 2014]

38. The base of a prism is a right-angled triangle with 2 sides 5 cm and 12 cm. The height of the prism is 10 cm. The total surface area of the prism is :

(a) 360 cm^2 (b) 300 cm^2
(c) 330 cm^2 (d) 325 cm^2

[SSC Examination, 2014]

39. The base of a right prism is an equilateral triangle. If the lateral surface area and volume is 120 cm^2 and $40\sqrt{3}$ cm^3, respectively, then the side of base of the prism is:

(a) 4 cm (b) 5 cm
(c) 7 cm (d) 40 cm

[SSC Examination, 2014]

40. A ball of lead, 4 cm in diameter, is covered with gold. If the volume of the gold and lead are equal, then the thickness of gold is approximately [given $\sqrt[3]{2} = 1.259$]

(a) 5.038 cm (b) 5.190 cm
(c) 1.038 cm (d) 0.518 cm

[SSC Examination, 2014]

41. A large solid sphere is melted and moulded to form identical right circular cones with base radius and height same as the radius of the sphere. One of these cones is melted and moulded to form a smaller solid sphere. Then the ratio of the surface area of the smaller to the surface area of the larger sphere is:

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(a) $1:3^{\frac{4}{3}}$ (b) $1:2^{\frac{3}{2}}$

(c) $1:3^{\frac{2}{3}}$ (d) $1:2^{\frac{4}{3}}$

[SSC Examination, 2014]

42. A conical cup is filled with ice cream. The ice cream forms a hemispherical shape on its open top. The height of the hemispherical part is 7 cm. The radius of the hemispherical part equals the height of the cone. Then the volume of the ice cream is $\left[\pi = \frac{22}{7}\right]$

(a) 1078 m^3 (b) 1708 m^3

(c) 7108 m^3 (d) 7180 m^3

[SSC Examination, 2014]

43. If each side of a cube is increased by 10%, the volume of the cube will increase by:

(a) 30% (b) 10%

(c) 33.1% (d) 25%

[SSC Examination, 2014]

44. A right circular cone is 3.6 cm high and radius of its base is 1.6 cm. It is melted and recast into a right circular cone with radius of its base as 1.2 cm. Then the height of the cone (in cm) is:

(a) 3.6 (b) 4.8

(c) 6.4 (d) 7.2

[SSC Examination, 2013]

45. If h, c, v are respectively the height, curved surface area and volume of a right circular cone, then the value of $3\pi vh^3 - c^2h^2 + 9v^2$ is:

(a) 2 (b) −1

(c) 1 (d) 0

[SSC Examination, 2013]

46. The volume of a conical tent is 1232 cu m and the area of its base is 154 m^2. Find the length of the canvas required to build the tent, if the canvas is 2 m in width. $\left(\text{Take } \pi = \frac{22}{7}\right)$

(a) 270 m (b)272 m

(c) 276 m (d)275 m

[SSC Examination, 2013]

47. Assume that a drop of water is spherical and its diameter is $\frac{1}{10}$ of a centimetre. A conical glass has a height equal to the diameter of its rim. If 32,000 drops of water fill the glass completely, then the height of the glass (in cm) is:

(a) 1 (b) 2

(c) 3 (d) 4

[SSC Examination, 2013]

48. The total number of spherical bullets, each of diameter 5 decimetre, that can be made by utilizing the maximum of a rectangular block of lead with 11 m length, 10 m breadth and 5 m width is (assume that π>3):

(a) Equal to 8800 (b) Less than 8800

(c) Equal to 8400 (d) Greater than 9000

[SSC Examination, 2013]

49. A rectangular block of metal has dimensions 21 cm, 77 cm and 24 cm. The block has been melted into a sphere. The radius of the sphere is $\left(\text{Take } \pi = \frac{22}{7}\right)$

(a) 21 cm (b) 7 cm

(c) 14 cm (d) 28 cm

[SSC Examination, 2013]

50. If a right circular cone of height 24 cm has a volume of 1232 cm^3, then the area (in cm^2) of curved surface is:

(a) 550 (b) 704

(c) 924 (d) 1254

[SSC Examination, 2013]

51. If each edge of a cube is increased by 50%, the percentage increase in surface area is:

(a) 125% (b) 50%

(c) 100% (d) 75%

[SSC Examination, 2013]

52. If the surface areas of two spheres are in the ratio 4:9, then the ratio of their volumes will be:

(a) 4:9 (b) 16:27

(c) 8:27 (d) 16:9

[SSC Examination, 2013]

53. If each edge of a cube is increased by 50%, the percentage increase in its surface area is:

(a) 150% (b) 75%

(c) 100% (d) 125%

[SSC Assistant Grade III, 2013]

54. The diameter of a copper sphere is 18 cm. The sphere is melted and is drawn into a long wire of uniform circular cross-section. If the length of the wire is 108 m, the diameter of the wire is:

(a) 1 cm (b) 0.9 cm

(c) 0.3 cm (d) 0.6 cm

[SSC Assistant Grade III, 2013]

55. A semicircular sheet of metal of diameter 28 cm is bent into an open conical cup. The capacity of the cup $\left(\text{taking } \pi = \frac{22}{7}\right)$ is:

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(a) 624.26 cm^3 (b) 622.36 cm^3
(c) 622.56 cm^3 (d) 623.20 cm^3

[SSC Assistant Grade III, 2013]

56. If surface area and volume of a sphere are S and V, respectively, then value of $\frac{S^3}{V^3}$ is:

(a) 36π (b) 9π
(c) 18π (d) 27π

[SSC Assistant Grade III, 2013]

57. A solid sphere of radius 1 cm is melted to convert into a wire of length 100 cm. The radius of the wire (using $\sqrt{3} = 1.732$) is:

(a) 0.08 cm (b) 0.09 cm
(c) 0.16 cm (d) 0.11 cm

[SSC Assistant Grade III, 2012]

58. A field is in the form of a rectangle of length 18 m and width 15 m. A pit, 7.5 m long, 6 m broad and 0.8 m deep, is dug in a corner of the field and the earth taken out is evenly spread over the remaining area of the field. The level of the field raised is:

(a) 12 cm (b) 14 cm
(c) 16 cm (d) 18 cm

[SSC Assistant Grade III, 2012]

59. The base of a right pyramid is an equilateral triangle of side 4 cm. The height of the pyramid is half of its slant height. Its volume is:

(a) $\frac{8}{9}\sqrt{2}$ cm^3 (b) $\frac{7}{9}\sqrt{3}$ cm^3
(c) $\frac{8}{9}\sqrt{3}$ cm^3 (d) $\frac{7}{9}\sqrt{2}$ cm^3

[SSC Assistant Grade III, 2012]

60. Water flows in a tank $150\text{ m} \times 100\text{ m}$ at the base, through a pipe whose cross-section is 2 dm by 1.5 dm, at the speed of 15 Km/h. In what time will the water be 3 m deep?

(a) 100 hours (b) 120 hours
(c) 140 hours (d) 150 hours

[SSC Assistant Grade III, 2012]

61. A tent is of the shape of a right circular cylinder upto a height of 3 m and then becomes a right circular cone with maximum height of 13.5 m above the ground. If the radius of the base is 14 m, the cost of painting the inner side of the tent at the rate of ₹2 per m^2 is:

(a) ₹2,050 (b) ₹2,060
(c) ₹2,068 (d) ₹2,080

[SSC Assistant Grade III, 2012]

62. If the diameter of a sphere is decreased by 25%, its curved surface area will be decreased by:

(a) 43.25% (b) 43.50%
(c) 43.75% (d) 44.25%

[SSC Assistant Grade III, 2012]

63. The radius of a cylinder is 10 cm and height is 4 cm. The number of centim that may be added either to the radius or to the height to get the same increase in the volume of the cylinder is:

(a) 5 (b) 4
(c) 25 (d) 16

[SSC Examination, 2012]

64. If a solid cone of volume 27 π cm^3 is kept inside a hollow cylinder whose radius and height are that of the cone, then the volume of water needed to the empty space is:

(a) 3π cm^3 (b) 18π cm^3
(c) 54π cm^3 (d) 81π cm^3

[SSC Examination, 2012]

65. Two cm of rain has fallen on a square Km of land. Assuming that 50% of the raindrops could have been collected and contained in a pool having a 100 m × 10 m base, by what level would he water level in the pool have increased?

(a) 1 Km (b) 10 m
(c) 10 cm (d) 1 m

[SSC Examination, 2012]

66. A cylindrical can whose base horizontal and is of internal radius 3.5 cm contains sufficient water so that when a solid sphere is placed inside, water just covers the sphere. The sphere fits in the can exactly. The depth of water in the can before the sphere was put is:

(a) $\frac{35}{3}$ cm (b) $\frac{17}{3}$ cm
(c) $\frac{7}{3}$ cm (d) $\frac{14}{3}$ cm

[SSC Examination, 2012]

67. The height of a circular cylinder is increased 6 times and the base area is decreased to $\frac{1}{9}$ of its value. The factor by which the lateral surface of the cylinder increases is:

(a) 2 (b) $\frac{1}{2}$
(c) $\frac{2}{3}$ (d) $\frac{3}{2}$

[SSC Examination, 2012]

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68. The volume of a right circular cone is 1232 cm^3 and its vertical height is 24 cm. Its curved surface area is:

(a) 154 cm^2 (b) 550 cm^2
(c) 604 cm^2 (d) 704 cm^2

[SSC Examination, 2012]

69. The height of a right prism with a square base is 15 cm. If the area of the total surfaces of the prism is 608 cm^2, its volume is:

(a) 910 cm^2 (b) 920 cm^2
(c) 960 cm^2 (d) 980 cm^2

[SSC Examination, 2012]

70. The volume of a solid hemisphere is 19404 cm^3. Its total surface area is:

(a) 4158 cm^3 (b) 2858 cm^3
(c) 1738 cm^3 (d) 2038 cm^3

[SSC Examination, 2012]

71. The heights of a cone, cylinder and hemisphere are equal. If their radii are in the ratio 2:3:1, then the ratio of their volumes is:

(a) 2:9:2 (b) 4:9:1
(c) 4:27:2 (d) 2:3:1

[SSC Examination, 2011]

72. Base of a right pyramid is a square, length of diagonal of the base is $24\sqrt{2}$ m. If the volume of the pyramid is 1728 cu. m, its height is:

(a) 7 m (b) 8 m
(c) 9 m (d) 10 m

[SSC Examination, 2011]

73. The height of a right circular cone and the radius of its circular base are 9 cm and 3 cm respectively. The cone is cut by a plane parallel to its base so as to divide it into two parts. The volume of the frustum (i.e., the lower part) of the cone is 44 cm^2. The radius of the upper circular surface of the frustum $\left(\text{taking } \pi = \dfrac{22}{7}\right)$ is:

(a) $\sqrt[3]{12}$ cm (b) $\sqrt[3]{13}$ cm
(c) $\sqrt[3]{6}$ cm (d) $\sqrt[3]{20}$ cm

[SSC Examination, 2011]

74. The ratio of radii of 2 right circular cylinders is 2:3 and their heights are in the ratio 5:4. The ratio of their curved surface area is:

(a) 5:6 (b) 3:4
(c) 4:5 (d) 2:3

[SSC Examination, 2011]

75. A solid cylinder has total surface area of 462 sq.cm. Curved surface area is $\frac{1}{3}$rd of its total surface area. The volume of the cylinder is:

(a) 530 cm^2 (b) 536 cm^2
(c) 539 cm^2 (d) 545 cm^2

[SSC Examination, 2011]

76. A cylinder and a cone have equal radii of their bases and equal heights. If their curved surface areas are in the ratio 8:5, the ratio of their radius and height is:

(a) 1:2 (b) 1:3
(c) 2:3 (d) 3:4

[SSC Examination, 2011]

77. A solid is hemispherical at the bottom and conical above. If the surface areas of the two parts are equal, then the ratio of radius and height of its conical part is:

(a) 1:3 (b) 1:1
(c) 3:1 (d) $1:\sqrt{3}$

[SSC Examination, 2011]

78. Base of a right prism is an equilateral triangle of side 6 cm. If the volume of the prism is $108\sqrt{3}$ cc, its height is:

(a) 9 cm (b) 10 cm
(c) 11 cm (d) 12 cm

[SSC Examination, 2011]

79. The number of coins, each of radius 0.75 cm and thickness 0.2 cm, to be melted to make a right circular cylinder of height 8 cm and radius 3 cm, is:

(a) 640 (b) 600
(c) 500 (d) 480

[SSC Examination, 2010]

80. If the radius of a sphere is increased by 2 m, its surface area is increased by 704 m^2. What isthe radius of the original sphere? $\left(\text{use } \pi = \dfrac{22}{7}\right)$

(a) 16 m^2 (b) 15 m^2
(c) 14 m^2 (d) 13 m^2

[SSC Examination, 2010]

81. A right circular cylinderis circumscribing a hemisphere such that their bases are common. The ratio of their volumes is.

(a) 1:3 (b) 1:2
(c) 2:3 (d) 3:4

[SSC Examination, 2010]

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82. 3 spherical balls of radii 1 cm, 2 cm and 3 cm are melted to form a single spherical ball. In the process, the loss of material is 25%. The radius of the new ball is:

(a) 6 cm (b) 5 cm
(c) 3 cm (d) 2 cm

[SSC Examination, 2010]

83. The length of the diagonal of a cube is 6 cm. The volume of the cube (in cm^3) is:

(a) $18\sqrt{3}$ (b) $24\sqrt{3}$
(c) $28\sqrt{3}$ (d) $30\sqrt{3}$

[SSC Examination, 2010]

84. If a sphere of radius r is divided into 4 identical parts, then the total surface area of the 4 parts is:

(a) $4\pi r^2$ square units
(b) $2\pi r^2$ square units
(c) $8\pi r^2$ square units
(d) $3\pi r^2$ square units

[SSC Examination, 2010]

85. A rectangular plot, 36 m long and 28 m broad, has two concrete roads 5 m wide running in the middle of the park,one parallel to the length and the other parallel to the breadth. What would be the total cost of gravelling the plot, excluding the area covered by the roads, at ₹3.60 per m^2?

(a) ₹2772.20 (b) ₹2466.60
(c) ₹2654.40 (d) ₹2332.60
(e) ₹2566.80

[IBPS PO/MT Examination, 2014]

86. The edge of an ice cube is 14 cm. The volume of the largest cylindrical ice cube that can be formed out of it is

(a) 2200 cm^3 (b) 2000 cm^3
(c) 2156 cm^3 (d) 2400 cm^3
(e) None of these

[IBPS PO/MT Examination, 2013]

Directions (Q. 87–91): Study the following information and answer the questions that follow:
The premises of a bank are to be renovated. The renovation is in terms of flooring. Certain areas are to be floored either with marble or wood. All rooms/halls and pantry are rectangular. The area to be renovated comprises a hall for customer transaction measuring 23 m by 29 m, the branch manager's room measuring 13 m by 17 m, a pantry measuring 14 m by 13 m, a record keeping-cum-server room measuring 21 m by 13 m and locker area measuring 29 m by 21 m. The total area of the bank is 2000 m^2. The cost of wooden flooring is ₹170 per m^2 and the cost of marble flooring is ₹190 per sm^2. The locker area, record keeping-cum-server room and pantry are to be floored with marble. The branch manager's room and hall for customer transaction are to be floored with wood. No other area is to be renovated in terms of flooring.

87. What is the ratio of the total cost of wooden flooring to the total cost of marble flooring?

(a) 1879:2527
(b) 1887:2386
(c) 1887:2527
(d) 1829:2527
(e) 1887:2351

[IBPS PO/MT Examination, 2012]

88. If the 4 walls and ceiling of the branch manager's room (the height of the room is 12 m) are to be painted at the cost of ₹190 per m^2, how much will be the total cost of renovation of the branch manager's room, including the cost of flooring?

(a) ₹1,36,800 (b) ₹2,16,660
(c) ₹1,78,790 (d) ₹2,11,940
(e) None of these

[IBPS PO/MT Examination, 2012]

89. If the remaining area of the bank is to be carpeted at the rate of ₹110 per m^2, how much will be the increment in the total cost of renovation of bank premises?

(a) ₹5,820 (b) ₹4,848
(c) ₹3,689 (d) ₹6,690
(e) None of these

[IBPS PO/MT Examination, 2012]

90. What is the percentage area of the bank that is not to be renovated?

(a) 2.2% (b) 2.4%
(c) 4.2% (d) 4.4%
(e) None of these

[IBPS PO/MT Examination, 2012]

91. What is the total cost of renovation of the hall for customer transaction and the locker area?

(a) ₹2,29,100 (b) ₹2,30,206
(c) ₹2,16,920 (d) ₹2,42,440
(e) None of these

[IBPS PO/MT, 2012]

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ANSWER KEYS

Exercise-1

1. (c)	**2.** (b)	**3.** (c)	**4.** (b)	**5.** (c)	**6.** (b)	**7.** (c)	**8.** (c)	**9.** (b)	**10.** (a)	**11.** (d)	**12.** (b)
13. (b)	**14.** (c)	**15.** (c)	**16.** (c)	**17.** (b)	**18.** (a)	**19.** (d)	**20.** (c)	**21.** (b)	**22.** (d)	**23.** (c)	**24.** (c)
25. (c)	**26.** (a)	**27.** (d)	**28.** (a)	**29.** (c)	**30.** (c)	**31.** (d)	**32.** (b)	**33.** (d)	**34.** (a)	**35.** (b)	**36.** (a)
37. (a)	**38.** (d)	**39.** (d)	**40.** (b)	**41.** (a)	**42.** (c)	**43.** (b)	**44.** (c)	**45.** (a)	**46.** (a)	**47.** (c)	**48.** (d)
49. (a)	**50.** (a)	**51.** (a)	**52.** (b)	**53.** (d)	**54.** (b)	**55.** (d)	**56.** (b)	**57.** (d)	**58.** (c)	**59.** (d)	**60.** (b)
61. (a)	**62.** (b)	**63.** (b)	**64.** (b)	**65.** (b)	**66.** (a)	**67.** (a)	**68.** (c)	**69.** (b)	**70.** (d)	**71.** (b)	**72.** (c)
73. (c)	**74.** (a)	**75.** (d)	**76.** (b)	**77.** (b)	**78.** (c)	**79.** (a)	**80.** (b)	**81.** (d)	**82.** (b)	**83.** (a)	**84.** (c)
85. (c)	**86.** (b)	**87.** (a)	**88.** (c)	**89.** (b)	**90.** (c)	**91.** (b)	**92.** (a)	**93.** (b)	**94.** (a)	**95.** (c)	**96.** (a)
97. (b)	**98.** (c)	**99.** (c)	**100.** (c)	**101.** (a)	**102.** (d)	**103.** (a)	**104.** (b)	**105.** (a)	**106.** (c)	**107.** (a)	**108.** (b)
109. (d)	**110.** (c)	**111.** (c)	**112.** (b)	**113.** (c)	**114.** (c)	**115.** (b)					

Exercise-2

1. (d)	**2.** (d)	**3.** (b)	**4.** (b)	**5.** (b)	**6.** (b)	**7.** (b)	**8.** (c)	**9.** (c)	**10.** (b)	**11.** (b)	**12.** (b)
13. (d)	**14.** (c)	**15.** (a)	**16.** (d)	**17.** (b)	**18.** (d)	**19.** (d)	**20.** (a)	**21.** (a)	**22.** (b)	**23.** (c)	**24.** (d)
25. (c)	**26.** (a)	**27.** (c)	**28.** (c)	**29.** (a)	**30.** (d)	**31.** (b)	**32.** (b)	**33.** (b)	**34.** (d)	**35.** (b)	**36.** (c)
37. (a)	**38.** (c)	**39.** (a)	**40.** (d)	**41.** (d)	**42.** (a)	**43.** (c)	**44.** (c)	**45.** (d)	**46.** (d)	**47.** (d)	**48.** (a)
49. (a)	**50.** (a)	**51.** (a)	**52.** (c)	**53.** (d)	**54.** (d)	**55.** (b)	**56.** (a)	**57.** (d)	**58.** (c)	**59.** (c)	**60.** (a)
61. (c)	**62.** (c)	**63.** (a)	**64.** (c)	**65.** (b)	**66.** (c)	**67.** (a)	**68.** (b)	**69.** (c)	**70.** (a)	**71.** (c)	**72.** (c)
73. (b)	**74.** (a)	**75.** (c)	**76.** (d)	**77.** (d)	**78.** (d)	**79.** (a)	**80.** (d)	**81.** (c)	**82.** (c)	**83.** (b)	**84.** (c)
85. (e)	**86.** (c)	**87.** (c)	**88.** (e)	**89.** (e)	**90.** (b)	**91.** (a)					

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EXPLANATORY ANSWERS

Exercise-1

1. **(c)** Volume of water $= 16 \times 12 \times \dfrac{16\frac{2}{3}}{100}$ m^3

$= 16 \times 12 \times \dfrac{50}{3 \times 100}$ m^3

$= 32$ m^3.

2. **(b)** Since the wood is 1 cm thick, the inner measurements are

$l = 12$ cm $- 2$ cm $= 10$ cm

$b = 10$ cm $- 2$ cm $= 8$ cm

$h = 8$ cm $- 2$ cm $= 6$ cm

Capacity of the box $= l \times b \times h$

$= 10$ cm $\times 8$ cm $\times 6$ cm

$= 480$ cm^3.

3. **(c)** Volume of the cistern $= 2.4 \times 2 \times 1.5$ m^3

$= 7.2$ m^3

Time taken = 2.5 hours

$\therefore$ Rate of water flow $= \dfrac{7.2}{2.5}$ m^3/hours

$= \dfrac{7.2 \times 100 \times 100 \times 100}{2.5 \times 60 \times 60}$

$= 800$ m^3/sec.

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4. **(b)** Let, the sides of the box be x, y and z.
Then, $p = xy$, $q = yz$, $r = zx$
Volume of the box $= xyz$
We have, $p \times q \times r = xy \times yz \times zx = x^2y^2z^2$
or, $xyz = \sqrt{pqr}$.

5. **(c)** Volume of water lowered $= 30 \times 15 \times 4$ m^3 = 1800 m^3
$\therefore$ Number of gallons taken out
$= 1800 \times 180$ gallons
$= 324000$ gallons
[1 m^3 of water = 180 gallons]

6. **(b)** Number of bricks
$= \dfrac{\text{Volume of the wall}}{\text{Volume of the brick}}$
$= \dfrac{(5 \times 100) \times (3 \times 100) \times 20}{25 \times 12.5 \times 7.5} = 1280.$

7. **(c)** Volume of the wood $= \dfrac{31}{2} \times \dfrac{11}{4} \times \dfrac{4}{3}$ m^3 = 93.5 m^3
Cost of the wood = ₹45 × 93.5 = ₹4207.50.

8. **(c)** Number of bricks
$= \dfrac{\text{Volume of the wall}}{\text{Volume of the brick}}$
$= \dfrac{1500 \text{ cm} \times 300 \text{ cm} \times 50 \text{ cm}}{12 \text{ cm} \times 12 \text{ cm} \times 6 \text{ cm}} = 12500$

9. **(b)** Length of the diagonal
$= \sqrt{12^2 + 10^2 + 8^2}\,\text{m}$
$= \sqrt{308}\,\text{m}$
$= 17.5$ m

10. **(a)** External dimensions
$l = 12$ cm, $b = 10$ cm, $h = 8$ cm
External volume = 12 cm × 10 cm × 8 cm
= 960 cm^3
Internal dimensions
$l = 12 - 2 = 10$ cm
$b = 10 - 2 = 8$ cm
$h = 8 - 2 = 6$ cm
Internal volume = 10 cm × 8 cm × 6 cm
= 480 cm^3
Volume of the wood = 960 cm^3 − 480 cm^3
= 480 cm^3
Cost of the wood = ₹(480 × 3) = ₹1440.

11. **(d)** Let, the side of the cube be x units
$\therefore$ Surface area of cube $= 6x^2$
$\therefore$ Sum of the areas of three cubes $= 18x^2$
For the cuboid, length $= 3x$ units
Breadth $= x$ units
height $= x$ units
$\therefore$ Surface area $= 2\,[lb + bh + hl]$
$= 2\,[3x \times x + x \times x + x \times 3x]$
$= 2\,(7x^2) = 14x^2$
$\therefore \dfrac{\text{Surface area of new cuboid}}{\text{Total surface area of three cubes}}$
$= \dfrac{14x^2}{18x^2} = \dfrac{7}{9}$.

13. **(b)** Let, the sides be x, $5x$.
Cubic cm of iron sheet $= 0.5 \times x \times 5x = 2.5x^2$
This should be the volume of the cube
$\therefore$ $2.5x^2 = 10 \times 10 \times 10$
$x^2 = \dfrac{1000 \times 10}{25}$
$\therefore$ $x = 20$ $\therefore$ Sides are 20, 100 cm.

14. **(c)** Capacity of the room $= 12 \times 8 \times 6$ cm^3
The required number of boxes $= \dfrac{12 \times 8 \times 6}{1.5} = 384.$

15. **(c)** Length $= \dfrac{3}{2}$ × breadth; height $= 3\dfrac{3}{10}$ m $\dfrac{3}{2}$ × breadth × breadth × $\dfrac{33}{10} = 123\dfrac{3}{4}$ m^3 or, (breadth)^2
$= \dfrac{445}{5} \times \dfrac{2}{3} \times \dfrac{10}{33} = 25$ m^2.
$\therefore$ Breadth $= \sqrt{25} = 5$ m
$\therefore$ Length $= \dfrac{3}{5} \times 5 = 7.5$ m

16. **(c)** Volume of earth dug out $= (3 \times 2 \times 1.5)$ m^3 = 9 m^3
Area over which earth is spread
$= [(22 \times 141) - (3 \times 2)]$ m^2 = 302 m^2
$\therefore$ Increase in level $= \dfrac{9}{302}$ m $= \dfrac{9 \times 100}{302}$ cm
= 2.98 cm.

17. **(b)** $14 \times b = 70 \times 2.2$
$\therefore$ $b = \dfrac{70 \times 2.2}{14} = 11$ m
and $l \times b \times h = 70 \times 11$
$\therefore$ $h = \dfrac{70 \times 11}{l \times b} = \dfrac{70 \times 11}{70 \times 2.2} = 5$ m.

18. **(a)** Let, the initial height be h and the height after sand is thrown be H m.
We have to find out $H - h$.
According to question,
$12 \times 5 \times (H - h) = 210$
$\therefore$ $H - h = \dfrac{210}{60} = \dfrac{7}{2} = 3.5$ m.

19. **(d)** Let, the length, breadth and height be $6x$, $5x$ and $4x$ m, respectively.
Then, $2 \times [6x \times 5x + 4x \times 5x + 4x \times 6x] = 33300$
$\therefore$ $148x^2 = 33300$.

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or, $x^2 = 225$ or, $x = 15$

So, length = 90 m

breadth = 75 m

height = 60 m.

20. **(c)** (Area of the square end) × 9 = Volume = 1 m^3

∴ Side of the square end = $\sqrt{\frac{1}{9}}$ m = $\frac{1}{3}$ m

∴ Volume of this cube = $\left(\frac{1}{3}\right)^3$ m^3 = $\frac{1}{27}$ m^3

∴ Weight of this cube = $\frac{1}{27} \times 90$ Kg = $3\frac{1}{3}$ Kg.

21. **(b)** $6e^2 = 24$ cm^2, so that e (edge) = 2 cm

∴ Number of such cubes out of a cube of edge 1 m (or 100 cm)

$= \left(\frac{100}{2}\right)^3 = 125000.$

22. **(d)** Side of the new cube

$= \sqrt[3]{\text{Sum of the cubes of sides of all the cubes}}$

∴ Side = $\sqrt[3]{6^3 + 8^3 + 10^3} = \sqrt[3]{216 + 512 + 1000}$

$= \sqrt[3]{1728}$ = 12 cm.

23. **(c)** Number of cubes

$= \left(\frac{\text{Original length of edge}}{\text{New length of edge}}\right)^3$

∴ Number of cubes = $\left(\frac{6}{2}\right)^3$ = 27.

24. **(c)** Volume of the cube with side 20 cm sides = $(20)^3$ = 8000 cm^3

Volume of the cube of sides 5 cm = 125 cm^3

∴ Number of smaller cubes of 5 cm sides = $\frac{8000}{125}$ = 64.

25. **(c)** Surface area of a cube = 6 × $(\text{side})^2$

∴ 6 × $(\text{side})^2$ = 600

⇒ $(\text{Sides})^2$ = 100

⇒ Side = $\sqrt{100}$ = 10 cm

∴ Diagonal of the cube = $\sqrt{3}$ × side

$= \sqrt{3} \times 10 = 10\sqrt{3}$ cm.

26. **(a)** Volume of water collected in the tank in 8 hours

= 30 m × 20 m × 1 m

= 600 cm^3.

∴ Volume of water collected in the tank in 1 hour

$= \frac{600}{8}$ = 75 cm^3.

Water comes through a pipe of cross–section

= 5 cm × 5 cm = $\frac{25}{10000}$ m^2.

The speed of water = Distance travelled by the water in the pipe in one hour

$= \frac{75 \times 10000}{25}$ m = 30 Km/h.

27. **(d)** Volume of the wall = $10 \times \frac{4}{10} \times 5$

= 20 m^3.

Volume of the mortar = $\frac{10}{100} \times 20$ = 2 cm^3.

Hence, the volume occupied by the bricks

= 20 − 2 = 18 m^3

Volume of each brick = $\frac{25}{100} \times \frac{15}{100} \times \frac{8}{100}$ m^3.

$= \frac{3}{1000}$ m^3.

Therefore, the required number of bricks

$= 18 \div \frac{3}{1000} = 6000.$

28. **(a)** Since the edges of the cubes are in the ratio 3:4:5, let these be $3k$, $4k$, $5k$ m, respectively.

Their volumes are 27 k^3, 64 k^3, 125 k^3 m^3.

Thus, the volume of the single cube

= (27 + 64 + 125) k^3 m^3

= 216 k^3 = $(6k)^3$ m^3

We know that the length of the diagonal of a cube with side x is $\sqrt{3}\,x$. Therefore, the length of the diagonal of the single cube mentioned in the equestion is equal to $6k\sqrt{3}$. But, the length of the diagonal of this cube is given to be 48 $\sqrt{3}$, hence

$6k\sqrt{3} = 48\sqrt{3}$, or, $k = 8$.

Therefore, the length of the edges of the three cubes are 3 × 8, 4 × 8, 5 × 8 m, that is, 24 m, 32 m, 40 m.

29. **(c)** Edge of the cube = 6 cm.

∴ Volume of lead = 6^3 cm^3 = 216 cm^3.

Let, the edge of the new cube be x cm.

Then, $27x^3 = 216$

⇒ $x^3 = 8$ or, $x = 2$ cm.

30. **(c)** Length of the cube = $(729)^{1/3}$ = 9

Total surface area = 6 × $(9)^2$ = 486 cm^2.

31. **(d)** $a_1^3 : a_2^3$ = 1:27

⇒ $a_1 : a_2$ = 1:3

∴ Required ratio is $1^2 : 3^2$ = 1:9.

32. **(b)** 4 (24 × 12) + 2 (12 × 12) = 1440 cm^2.

33. **(d)** $4a = 20$ ⇒ $a = 5$

∴ Volume = $a^3 = 5^3$ = 125 cm^3.

34. **(a)** Ratio of the edge of cubes

= 3:12 = 1:4

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Ratio of their volumes = $1^3:4^3$ = 1:64.

Because volume of the new cube is 64 times the volume of the first cube, the weight of the new cube is also 64 times the weight of the first cube.

Weight of the new cube

= 64 × 12 gm = 768 gm

35. **(b)** When edge is increased 3 times, the volume or weight is increased 3^3, i.e., 27 times.

$\therefore$ The weight of the other cube

= 27 × 17 = 459 gm.

36. **(a)** Let, x be the side of the base of the 16 m long square bar.

$\therefore$ $16 \times x^2 = 1$

or, $x^2 = \frac{1}{16}$ or, $x = \frac{1}{4}$ m

Volume of the cube of edge $\frac{1}{4}$ m = $\frac{1}{16}$ m^3

Now, 1 m^3 weighs 900 Kg

$\therefore$ $\frac{1}{16}$ m^3 weighs $\frac{900}{64}$ Kg = 14 Kg $62\frac{1}{2}$ gm.

38. **(c)** Sum of the surface areas of three smaller cubes

$= 6 \times 3^2 + 6 \times 4^2 + 6 \times 5^2$

= 300 cm^2.

Volume of large cube = $3^3 + 4^3 + 5^3 = 216$ cm^3.

$\therefore$ The edge of large cube = 6 cm.

$\therefore$ The surface area of large cube = $6 \times 6^2 = 216$ cm^2.

Total surface area of smaller cubes: surface area of large cube

= 300:216 = 25:18.

39. **(d)** The edge of the small cube = $\sqrt{\frac{96}{6}}$ = 4 m.

The edge of the large cube = $\sqrt{\frac{384}{6}}$ = 8 cm.

The number of small cubes $= \frac{8 \times 8 \times 8}{\frac{4}{10} \times \frac{4}{10} \times \frac{4}{10}} = 8000.$

40. **(b)** Volume of the cubical metallic tank

$= l \times b \times h$

= 30 × 30 × 30

= 27000 cm^3

$\therefore$ Volume of water in the tank $= \frac{27000}{1000}$.

= 27 litre [$\because$ 1 litre = 100 cm^3]

$\therefore$ Volume of remaining water

= 24.3 litre = 243000 cm^3

Now, $l \times b \times h = 243000$

$\Rightarrow$ $30 \times 30 \times h = 243000$ $\Rightarrow$ $h = 27$ cm.

41. **(a)** External radius of the pipe = $\frac{8}{4}$ = 4 cm.

External volume = $\pi r^2 h$

$= \frac{22}{7} \times 4 \times 4 \times 28$

= 1408 cm^3

Internal diameter = 8 − 1 = 7 cm

Internal radius = $\frac{7}{2}$ = 3.5 cm

Internal volume = $\pi r^2 h$

$= \frac{22}{7} \times 3.5 \times 3.5 \times 28$

= 1078 cm^3.

Weight of lead = 330 × 11.4 = 3762 g = 3.762 Kg.

42. **(c)** Height of the cylinder

$= \frac{\text{Volume of cylinder}}{\text{Base Area}}$

$= \frac{1650}{78\frac{4}{7}} = 21$ m.

43. **(b)** Let, the outer radius be x cm.

Then, we have

$1496 = \pi \times (28) \times (x^2 - 8^2)$

$\Rightarrow$ $x^2 - 8^2 = \frac{1496 \times 7}{22 \times 28} = 17$

or, $x^2 = 17 + 64 = 81$

$\therefore$ $x = 9$ cm.

44. **(c)** Curved surface area = πrh

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

Total area of plane faces

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

$= \frac{22}{7} \times 7^2 + 2 \times 7 \times 10$

= 154 + 140 = 294 cm^2.

Total surface area

= 220 + 294 = 514 cm^2.

45. **(a)** Let, the radius of the sphere and cylinder be 'R' and 'r', respectively

Volume of the cylinder

$= \pi r^2 h = \pi r^2 \left(\frac{9}{2} r\right) \left(\because h = \frac{9}{2} r\right)$

$= \frac{9}{2} \pi r^3$

Volume of the sphere = $\frac{4}{3} \pi R^3$.

As per the given equestion:

Volume of the sphere = Volume of the cylinder

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or, $\frac{4}{3}\pi R^3 = \frac{9}{2}\pi r^3$

or, $\left(\frac{R}{r}\right)^3 = \frac{27}{8}$

$\therefore$ $\frac{R}{r} = \frac{3}{2}$.

46. **(a)** $\frac{4}{3}\pi r^3 = \pi r^2 h \Rightarrow h = \frac{4}{3}r$.

47. **(c)** Volume of the earth dug
= Volume of the well
$= \pi r^2 h = \frac{22}{7}\times\frac{3.5}{2}\times\frac{2.5}{2}\times 12$
$= \frac{231}{2}$ cm^3
Area of the platform
= 10.5 m × 8.8 m
= 92.4 m^2
Height of the platform $= \frac{231}{2}\times\frac{1}{92.4} = 1.25$ m.

48. **(d)** Let, r and h be the radius and depth of the well, respectively, then
Curved surface $= 2\pi rh = 264$ m^2. …(1)
Volume $= \pi r^2 h = 924$ m^3.
$\Rightarrow \frac{\pi r^2 h}{2\pi rh} = \frac{924}{264}$
or, $r = \frac{2\times 924}{264} = 7$ m
$\therefore$ Diameter = 14 m
$\therefore$ from Equation (1), we get
$2\pi \times 7 \times h = 264$
or, $h = \frac{264}{14\times\pi} = \frac{264\times 7}{14\times 22} = 6$ m.

49. **(a)** $r + h = 37$ and $2\pi r(r + h) = 1628$
or, $\pi r = \frac{1628}{74} = 22$
$\therefore$ $r = 7$ cm and $h = 37 - 7 = 30$ m
$\therefore$ Volume $= \pi r^2 h = \frac{22}{7}\times 7\times 7\times 30$
$= 4620$ m^3.

50. **(a)** Volume of the wall $= 25 \times 2 \times \frac{3}{4}$ m^3.
Volume of a brick $= \frac{20}{100}\times\frac{10}{100}\times\frac{15}{200}$
$= \frac{3}{2000}$ m^3.
The required number of bricks
$= \left(25\times 2\times\frac{3}{4}\right)\div\frac{3}{2000} = 25000$.

51. **(a)** $3 \times 2\pi r^2 = 2 \times 2\pi r \times 6$
$\therefore$ $r = 4$ m.

52. **(b)** $r \to 2r$, $h \to \frac{1}{4}h$, then:
Volume $= \pi (2r)^2 \times \frac{1}{4}h = \pi r^2 h$.

53. **(d)** Let, the height of the cylinder $= h$.
Then, $\pi r^2 h = \frac{1}{3}\pi r^2 H$
or, $\frac{h}{H} = \frac{1}{3} = 1:3$.

54. **(b)** The volume of cylindrical can $= \pi r^2 h$
$= \frac{22}{7}\times\left(\frac{10}{2}\right)^2\times 21\text{ cm}^3$
= 1650 cm^3
Volume of the square can = (side)^2 × h
= $(10)^2 \times 21$ cm^3 = 2100 cm^3
Difference in the capacities of the two cans
= (2100 − 1650) cm^3 = 450 cm^3.

55. **(d)** $r = \frac{84}{2}$ cm $= \frac{21}{50}$ m,
$h = 120$ cm $= \frac{120}{100}$ m $= \frac{6}{5}$ m
The levelled area in one revolution of the roller
= curved surface $= 2\pi rh$
$= 2 \times \frac{22}{7}\times\frac{21}{50}\times\frac{6}{5}$
$= \frac{396}{125}$ m^2.
The levelled area in 500 revolutions
$= \frac{396}{125}\times 500 = 1584$ m^2.
The required cost of levelling $= \frac{30}{100}\times 1584$
= ₹475.20.

56. **(b)** The radii of ends of the frustum are $\frac{48}{2\pi}, \frac{34}{2\pi}$
$\therefore$ Volume $= \frac{\pi}{3}\times 10\left\{\frac{48\times 48}{(2\pi)^2}+\frac{34\times 34}{(2\pi)^2}+\frac{48\times 34}{(2\pi)^2}\right\}$
$= \frac{10\pi}{3}$ {2304 + 1156 + 1632}
$= \frac{10\times 7\times 5092}{22\times 12}$
= 1350.

57. **(d)** $2\pi r = 8.8$ m
$2\pi rh = 17.6$ m
$\therefore$ $h = 2$ m, $r = 1.4$
Amount of concrete = volume
$= \pi r^2 h$

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$= \left(\frac{22}{7} \times \frac{14}{10} \times \frac{14}{10} \times 2\right)$

$= 12\ \frac{8}{25}\ m^3$.

58. (c) $l + b + h = s$ and $\sqrt{l^2 + b^2 + h^2} = d$

So, $l^2 + b^2 + h^2 = d^2$

$\therefore\ (l + b + h)^2 = s^2$

$\Rightarrow\ l^2 + b^2 + h^2 + 2\ (lb + bh + hl) = s^2$

$\Rightarrow\ d^2 + 2\ (lb + bh + hl) = s^2$

$\Rightarrow\ 2\ (lb + bh + hl) = s^2 - d^2$

$\therefore$ Surface area $= s^2 - d^2$.

59. (d) Curved surface $= 2\pi rh$

$= 2 \times \frac{22}{7} \times \frac{5}{2} \times 14 = 220\ m^2$

Cost for white washing = ₹$\left(220 \times \frac{1}{2}\right)$ = ₹110.

60. (b) Let, r be the radius

$\frac{4}{3}\pi r^3 = 49 \times 33 \times 24$

$r^3 = \frac{3 \times 7^2 \times 3 \times 11 \times 2^3 \times 3 \times 7}{2^2 \times 2 \times 11} = 3^3 \times 7^3$

$\therefore\ r = 3 \times 7 = 21$ cm.

61. (a) Radius of the coin $= r = \frac{1.5}{2} = \frac{3}{4}$ cm.

Thickness of the coin $= h = 2$ mm $= \frac{1}{5}$ cm.

$\therefore$ Volume of one cone $= \pi r^2 h = \pi \times \left(\frac{3}{4}\right)^2 \times \frac{1}{5}$.

$= \frac{9\pi}{80}\ m^3$

Radius of the cylinder $= R = 3$ cm.

Height of the cylinder $= H = 8$ cm.

$\therefore$ Volume of the cylinder $= \pi R^2 H = 72\pi\ cm^3$.

Number of coins $= \frac{\text{Volume of the cylinder}}{\text{Volume of the coin}}$

$= \frac{72\pi}{\pi/80} = 72 \times \frac{80}{9} = 640$.

62. (b) Let, r cm be the radius of base of the cone

$\frac{2}{3}\pi\ (6)^3 = \frac{1}{3}\pi r^2 \times 75$

$\therefore\ r^2 = \frac{2 \times 216}{75} = \frac{2 \times 72}{25}$

$\therefore\ r = \frac{12}{5} = 2.4$ cm.

63. (b) $2\pi rh + 2\pi r^2 = 231$

and $2\pi rh = \frac{2}{3} \times 231 = 154$

or, $2\pi r^2 = 77$ or, $\pi r^2 = \frac{22}{7}$

$\therefore\ r = \sqrt{\frac{77}{2} \times \frac{7}{22}} = \frac{7}{2}$ cm

Now, $2 \times \frac{22}{7} \times \frac{7}{2} \times h = 154$

$\therefore\ h = 7$ cm.

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

$= 269.5\ cm^3$.

64. (b) Volume of the water to pass through pipe in 1 min

$= \frac{440}{10} = 44\ cm^3$.

As the speed of the water is 7 m per min, Volume of the water per min is

$V = \pi r^2 \times 7$, where r is the inner radius of the pipe.

$\therefore\ 44 = \frac{22}{7} \times r^2 \times 7 \Rightarrow r^2 = 2$, or, $r = \sqrt{2}$ m.

65. (b) Required volume

= Volume of cylinder − Volume of cone

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

$= \frac{2}{3} \times \pi \times 36 \times 10$

$= \frac{2}{3} \times \frac{22}{7} \times 360 = \frac{5280}{7}$

$= 754.3\ cm^3$.

66. (a) $r = 2x$, $r_1 = 3x$

$h = 5y$, $h_1 = 3y$

Volume ratio $= \pi r^2 h : \pi r_1^2 h_1$

$= \pi \times (2x)^2 \times 5y : \pi \times (3x)^2 \times 3y$

$= 20\pi x^2 y : 27\pi x^2 y$

$= 20:27$.

67. (a) Radius of the base of the cylinder

$= r = 14$ m.

h = Depth of the tank

Capacity = Volume of the tank

$= \pi r^2 h = 6160\ m^3$.

or, $\frac{22}{7} \times 14 \times 14 \times h = 6160 \quad \therefore\ h = 10$ m.

T surface area $= 2\pi rh = 2 \times \frac{22}{7} \times 14 \times 10$

$= 880\ m^2$

$\therefore$ Cost of painting this curved surface

$= 880 \times 2.80$ = ₹2464.

68. (c) $(h + r) = 37$, $2\pi r\ (h + r) = 1628$

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

$\Rightarrow\ r = 7$ and $h = 30$

$\therefore$ Circumference $= 2\pi r = 2 \times \frac{22}{7} \times 7 = 44$ m.

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69. **(b)** Rolled along with its length, then h = 10 cm, and the other side = 22 cm.

$\therefore \quad V = \dfrac{10 \times (22)^2 \times 7}{4 \times 22} = 385 \text{ cm}^2.$

70. **(d)** $\dfrac{\text{Total surface area}}{\text{Lateral surface area}} = \dfrac{2\pi r h + 2\pi r^2}{2\pi rh}$

$= \dfrac{2\pi r(h+r)}{2\pi rh} = \dfrac{h+r}{h} = \dfrac{20+80}{20} = \dfrac{5}{1} = 5{:}1.$

71. **(b)** Let, x cones be needed

Then, $\dfrac{1}{3}\pi r^2 h \times x = \pi r^2 h,$ or, $x = 3.$

72. **(c)** Radius of the bucket = r = 14 cm

Height of the bucket = h = 72 cm

Volume of the water = Volume of the bucket

$= : \pi r^2 h = \dfrac{22}{7} \times 14 \times 14 \times 72$

$\therefore \quad 66 \times 28 \times H = \dfrac{22}{7} \times 14 \times 14 \times 72$

$\therefore \quad H = \dfrac{22 \times 72}{66} = 24$ cm.

73. **(c)** Volume of the iron rod = $\dfrac{22}{7} \times 1 \times 1 \times 70$

= 220 cu cm.

$\therefore$ Weight of the cylinder = $\dfrac{220 \times 10}{1000} = 2.2$ Kg.

74. **(a)** Let, the initial radius and height of the cylinder be r cm and h cm, respectively.

Then, curved surface area of the original cylinder = $2\pi rh$ and curved surface area of the new cylinder

$= 2\pi(2r) \times \dfrac{h}{2} = 2\pi rh$

$\therefore$ Required ratio

$= \dfrac{\text{New curved surface area}}{\text{Previous curved surface area}}$

$= \dfrac{2\pi rh}{2\pi rh} = 1{:}1.$

75. **(d)** Volume of the water in jar = $\pi \times 12^2 \times 30 \text{ cm}^3$

When the ball is dropped into the jar, volume of water + ball

$= \pi \times 12^2 \times (30 + 6.75)$

Increase in volume

$= \pi \times 12^2 \times (30 + 6.75 - 30) \text{ cm}^3$

$= \pi \times 144 \times 6.75 \text{ cm}^3$

It r is the radius of the ball, then

$\dfrac{4}{3}\pi r^3 = \pi \times 144 \times 6.75$

$\Rightarrow \quad r^3 = \dfrac{144 \times 6.75 \times 3}{4} = 729$

$\Rightarrow \quad r^3 = 9^3$

$\therefore \quad r = 9$

Thus, diameter of ball = $2r$ = 18 cm.

76. **(b)** Volume of the cylinder = 3 times volume of the cone. This is valid if base and height is the same. Radius is the same, so the height of cone is 3 times the height of the cylinder.

$\therefore$ Height of the cone = 3 × 5 cm = 15 m.

77. **(b)** $\dfrac{\text{First volume of cylinder}}{\text{Second volume of cylinder}}$

$= \dfrac{(\text{First radius})^2}{(\text{Second radius})^2} \times \dfrac{\text{First height}}{\text{Second height}}$

or, $\dfrac{3850}{\text{Second volume}} = \left(\dfrac{2}{1}\right)^2 \times \dfrac{1}{2}$

$\therefore$ Second volume = $\dfrac{1}{2} \times 3850 = 1925 \text{ mm}^2.$

78. **(c)** Radius of each pillar = 25 cm = $\dfrac{1}{4}$ m

Curved surface of one pillar = $2\pi rh$

$= 2 \times 3.14 \times \dfrac{1}{4} \times 4 = 6.28 \text{ m}^2$

$\therefore$ Curved surface of the 50 pillars = 314 m^2

Required cost of cleaning these pillars

$= 314 \times \dfrac{50}{100} =$ ₹157.

79. **(a)** Let, r be the radius and h be the height

$\pi(2r)^2 \times H = \pi r^2 h \quad \therefore \quad H = \dfrac{1}{4} \cdot h.$

80. **(b)** $\dfrac{4}{3}\pi r^3 = \dfrac{4}{3}\pi \times \left\{\left(\dfrac{3}{2}\right)^3 - \left[\left(\dfrac{3}{4}\right)^3 + 1^3\right]\right\}$

$\therefore \quad r^3 = \dfrac{125}{64}$

$\therefore \quad r^3 = \left(\dfrac{5}{4}\right)^3$

$\therefore \quad r = \dfrac{5}{4}$

$\therefore$ Diameter = $2r = 2 \times \dfrac{5}{4} = \dfrac{5}{2} = 2.5$ cm.

81. **(d)** $\pi rl = 2\pi r \cdot b,$ where b = 2 m $\Rightarrow$ l = 4 m.

82. **(b)** Let, the height and radius of the cylinder be h and r, respectively.

Curved surface of the cylinder = $2\pi rh$

Curved surface of the cone = $\pi rl = \pi rh$ ($h = l$)

$\therefore$ Required ratio = 2:1.

83. **(a)** Cylinder of largest possible volume is of base with diameter 1 m and height 1 m.

$\therefore$ The volume of this cylinder = $\pi \times \left(\dfrac{1}{2}\right)^2 \times 1$

$= \dfrac{\pi}{4} \text{ cm}^3.$

Hence, the volume of the remaining word is equal to $1 - \dfrac{\pi}{4}$

$= 1 - \dfrac{22}{7 \times 4} = \dfrac{3}{4}.$

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84. **(c)** Volume of cylinder = $\pi r^2 \times 3$ cm^3.

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

$\therefore \frac{1}{3}\pi r^2 h = 3\pi r^2$ or $h = 9$ cm.

85. **(c)** Volume of rain water

= Area × height = $(1 \text{ Km})^2 \times 2$ cm

= $(1000 \text{ m})^2 \times 0.02$ m = 20000 m^3

Volume of collected water = 50% of 20000 m^3

$= \frac{1}{2} \times 20000$

= 10000 m^3

$\therefore$ Increased level in pool

$= \frac{\text{Volume collected}}{\text{Base area of pool}} = \frac{10000}{10 \times 100} = 10$ m

$\therefore$ The water level would be increased by 10 m.

86. **(b)** $h = \frac{14}{3}$ m, $r = 3$ m

Volume = $\frac{22}{7 \times 3} \times 3 \times 3 \times \frac{14}{3} = 44$ cm^3

Average of air/person = $\frac{44}{11} = 4$ m^3.

87. **(a)** $2 \times \frac{22}{7} \times r = 44$ m

So, $r = 7$ m

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

$= \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 9$

$= 462$ m^3.

88. **(c)** Volume of conical vessel

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

$= \frac{88}{7}$ cm^3.

If the level of kerosene in the jar is x cm.

$\frac{88}{7} = \pi \times 2 \times 2 \times h = \frac{22}{7} \times 4 \times h$

$\therefore$ $h = 1$ cm.

89. **(b)** Let, the radius of the solid cylinder be r cm

$\therefore$ $\pi r^2 \times 9 = \pi [(4.3)^2 - (1.1)^2] \times 3$

$\Rightarrow$ $r^2 = \frac{3}{9}$ (4.3 + 1.1) (4.3 − 1.1)

$= \frac{1}{3} \times 5.4 \times 3.2 = 5.76$

$r = \sqrt{5.76} = 2.4$ cm.

90. **(c)** Let, the height of the cylinder be H and its radius = r.

Then, $\pi r^2 H + \frac{1}{3}\pi r^2 h = 3 \times \frac{1}{3}\pi r^2 h$

$\therefore$ $\pi r^2 H = \frac{2}{3}\pi r^2 h$ or, $H = \frac{2}{3}h$.

91. **(b)** Volume of earth dug out

$\pi r^2 h = \frac{22}{7} \times \left(\frac{11.2}{2}\right)^2 \times 8$

$= \frac{22}{7} \times 5.6 \times 5.6 \times 8 = 788.48$ m^3.

Area of embankment

$= \pi (5.6 + 7)^2 - \pi (5.6)^2$

$= \pi [(5.6 + 7)^2 - (5.6)^2]$

$= \pi [(5.6 + 7 + 5.6)(5.6 + 7 - 5.6)]$

$= \frac{22}{7}$ [18.2 × 7]

= 400.4 m^2.

92. **(a)** Curved surface area of cylinder = $2\pi rh$.

Slant surface area of the cone

$= \pi rl = \pi \times r \times 2h = 2\pi rh$

$\therefore$ The ratio of the two surface areas

$= 2\pi rh : 2\pi rh = 1:1$.

93. **(b)** $\frac{1}{3}\pi r^2 \times h = \pi r^2 \times 5$, or, $h = 15$ cm.

94. **(a)** Edge of the cube = $\sqrt[3]{343} = 7$ cm.

$\therefore$ Radius of the cone = 3.5 cm and height = 7 cm.

$\therefore$ Volume of the cone

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

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

$= \frac{1}{3} \times 22 \times 12.25$

= 90 c.c.

95. **(c)** Volume of the cone

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

$= \frac{1}{3} \times \frac{22}{7} \times 50 \times 50 \times 25$ c.c.

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

Since the sphere is made from the cone, their volumes will be equal

$\therefore$ $\frac{4}{3}\pi R^3 = \frac{1}{3} \times \frac{22}{7} \times 50 \times 50 \times 25$

$\Rightarrow$ $R^3 = \frac{1}{3} \times \frac{22}{7} \times 50 \times 50 \times 25 \times \frac{3}{4} \times \frac{7}{22}$

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or, $R^3 = 353$
or, $R = 25$ cm
Surface area of the sphere
$= 4\pi R^2$
$= 4 \times \dfrac{22}{7} \times 25 \times 25 = \dfrac{55000}{7}$
$= 7857.14$ cm^2.

96. (a) $\dfrac{1}{3} \times \pi \times (5x)^2 \times 12x = 314\dfrac{3}{7}$

$\Rightarrow \dfrac{1}{3} \times \dfrac{22}{7} \times 25 \times 12x^3 = \dfrac{2200}{7} \quad \Rightarrow \quad x^3 = 1$

i.e., $x = 1$.
$\therefore$ Radius $= 5x = 5 \times 1 = 5$ m.

97. (b) $\dfrac{1}{3}\pi \times r^2 \times r : \dfrac{2}{3}\pi r^3 : \pi r^2 \times r$

[height = radius of base]
or, 1:2:3.

98. (c) Curved surface of the tent $= \pi rl$

$= \dfrac{22}{7} \times 6 \times 6.3$ m^2

$= 118.8$ m^2

$\therefore$ Length of the canvas $= \dfrac{118.8}{2}$ m $= 59.4$ m.

99. (c) Let, the initial radius and height of the cylinder be r cm and h cm, respectively.

Then, $V_1 = \pi r^2 h$ and $V_2 = \pi (2r)^2 \dfrac{h}{2} = 2\pi r^2 h$.

$\dfrac{\text{New volume}}{\text{Previous volume}} = \dfrac{2\pi r^2 h}{\pi r^2 h} = \dfrac{2}{1} = 2:1$.

100. (c) Curved surface area of the cylindrical portion
$= 2\pi rh$
$= 2 \times \dfrac{22}{7} \times \dfrac{105}{2} \times 3$
$= 990$ m^2
Lateral surface area of the conical portion
$= \pi rl = \dfrac{22}{7} \times \dfrac{105}{2} \times 53$
$= 8745$ m^2
Total surface area $= 990 + 8745 = 9735$ m^2.
Width of the canvas = 5 m.
$\therefore$ Length of the canvas $= 9735 \div 5 = 1947$ m.

101. (a) Radius of the cone
$= r + 20\%$ of $r = 1.2\ r$ cm
and, slant height = 21 cm
$\therefore$ Surface area of the new cone
$= 2\pi \times 1.2\ r \times 2l$
$= 2\pi \times 2.4\ rl$ cm^2

Increase in surface area
$= 2\pi \times 2.4\ rl - 2\pi rl$
$= 2\pi \times 1.4\ rl$ cm^2
Percentage increase
$= \dfrac{2\pi \times 1.4\ rl}{2\pi\ rl} \times 100 = 140\%$
Therefore, surface area of the cone will be increased by 140%.

102. (d) Area of the canvas $= \pi rl = \pi \times 5 \times 13 = 65\ \pi$
$[l = \sqrt{5^2 + 12^2} = \sqrt{169} = 13]$

103. (a) Total volume $= (10 \times 5 \times 2)$ cm^3
$= 100$ cm^3
Volume carved $= \left(\dfrac{1}{3} \times \dfrac{22}{7} \times 3 \times 3 \times 7\right)$ cm^3
$= 66$ cm^3.
Wood wasted $= (100 - 66)\% = 34\%$

104. (b) Curved surface of the tomb
$= \pi rl = \dfrac{22}{7} \times 14 \times 50 = 22000$ m^2
$\therefore$ Cost of white washing
$= 22000 \times 0.80 =$ ₹1760.

105. (a) Length of the sheet $= \dfrac{264}{\pi} = 24$ cm

When the sheet is rolled along its breadth, the width of the sheet will be equal to the circumference of the cylinder and the length of the sheet will be height of the cylinder.
$\therefore$ Radius of the cylinder formed
$= \dfrac{11}{2\pi} = \dfrac{11}{2} \times \dfrac{22}{7} = \dfrac{7}{4}$ cm
Volume of the cylinder
$= \pi r^2 h = \dfrac{22}{7} \times \dfrac{7}{4} \times \dfrac{7}{4} \times 24 = 231$ cm^3.

106. (c) $h_1 : h_2 = 2:3$,
$r_1 : r_2 = 3:4$
Ratio of volumes $V_1 : V_2 = \pi (3)^2 \times 2 : \dfrac{1}{3}\pi \times 4^2 \times 3$
$= 9:8$.

107. (a) Original volume $= \dfrac{1}{3}\pi r^2 h$

New volume $= \dfrac{2}{3}\pi r^2 h$

Increase % $= \left(\dfrac{\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi r^2 h} \times 100\right)\% = 100\%$

108. (b) Volume of the cubes with sides 3, 4 and 5 cm are 3^3, 4^3 and 5^3, respectively.
$\therefore$ Total volume $= 3^3 + 4^3 + 5^3$ cm^3

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$= 27 + 64 + 125$

$= 216 \text{ cm}^3.$

109. (d) Let, radius of the cone = r, height = h.

Then, volume of the cone = $\frac{1}{3}\pi r^2 h$.

Increased radius = $2r$, height = $2h$

$\therefore$ Increased volume

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

= 8 times the original volume.

110. (c) Original volume = $\frac{4}{3}\pi r^3$

New volume $= \frac{4}{3}\pi(2r)^3 = \frac{32}{3}\pi r^3$

Increase % $= \left(\frac{28}{3}\pi r^3 \times \frac{3}{4\pi r^3} \times 100\right)\% = 700\%$

111. (c) Radius of the sphere = 3 cm

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

$= \frac{4}{3} \times \pi \times 3 \times 3 \times 3$

$= 36\pi \text{ cm}^3$ …(1)

Radius of the wire = 0.1 m.

Volume of the wire with its length l cm and radius 1.0 m

$= \pi r^2 l = \pi \times 0.1 \times 0.1 \times l$ …(2)

Now, $36\pi = \pi \times 0.1 \times 0.1 \times l$

$\Rightarrow \quad l = \frac{36\pi}{\pi \times 0.1 \times 0.1} = 3600 \text{ cm} = 36 \text{ m}.$

112. (b) If r is the radius of the base, then the circumference of the base = $2\pi r$ = 44 m.

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

The height of the cone = h

Then, the volume of the air in the tent

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

$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 9$

$= 462 \text{ m}^3.$

113. (c) Original area = $2\pi r^2$.

New area = $4\pi(2r)^2 = 16\pi r^2$.

Increase % $= \left(\frac{12\pi r^2}{4\pi r^2} \times 100\right)\% = 300\%$

114. (c) Here, $x = y = 0$ and $z = -8$.

$\therefore$ Percentage change in volume

$= \left[x + y + z + \frac{xy + yz + zx}{100} + \frac{xyz}{(100)^2}\right]\%$

$= \left[0 + 0 - 8 + \frac{0 \times 0 + 0 \times .8 + 0 \times .8}{(100)^2}\right]\%$

$= -8\%$

$\therefore$ Volume of the cylinder decreases by 8%.

115. (b) Here, $x = y = 20$ and $z = 0$.

$\therefore$ Percentage increase in volume

$= \left[x + y + z + \frac{xy + yz + zx}{100} + \frac{xyz}{(100)^2}\right]\%$

$= \left[20 + 20 + 0 + \frac{20 \times 20 + 20 \times 0 \times 20 \times 0}{100} + \frac{20 + 20 \times 0}{(100)^2}\right]\%$

$= (40 + 4)\% = 44\%$

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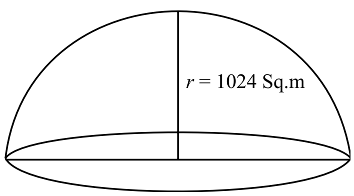
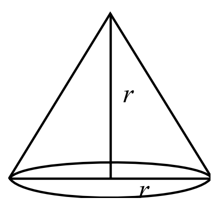
Exercise-2
(Based on Memory)

1. (d) Area of the square field

= Area of the rectangles field = 1024 m^2



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



Volume $= \frac{1}{3}\pi r^2 \cdot r = \frac{1}{3}\pi r^3$

$\therefore$ Required ratio = 2:1.

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2. (d) Given:

$\pi r^2 h = 924$ …(1)

$2\pi rh = 264$ …(2)

Where r = radius of the cylindrical pillar

$\therefore$ Eq. (1) ÷ Equation (2) gives

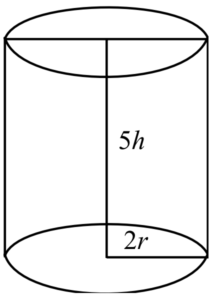
$$\frac{\pi r^2 h}{2\pi rh} = \frac{924}{264} \quad \Rightarrow \quad \frac{r}{2} = \frac{231}{66} = \frac{7}{2}$$

$\Rightarrow \quad r = 7 \Rightarrow \text{Diameter} = 14$.

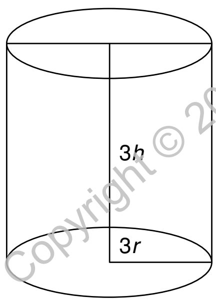
(2) $\Rightarrow 2\pi \times 7 \times h = 264$
$\Rightarrow 44h = 264 \Rightarrow h = 6$

$\therefore$ Required ratio: $\frac{2r}{h} = \frac{14}{6} = \frac{7}{3}$.

3. (b)



Volume $= \pi \times (2r)^2 \times 5h$
$= 20\pi r^2 h$



Volume $= \pi \times (3r)^2 \times 3h$
$= 27\pi r^2 h$

$\therefore$ Required ratio = 20:27.

4. (b) Let, l, b and h be the length, brea cdth and height of the cuboidal tank, respectively.

$\therefore \quad h = \frac{1}{3}l, b = \frac{1}{2} \text{ of } \frac{1}{3} \text{ of } (l - h)$

$= \frac{1}{6}l - \frac{1}{6}h = \frac{1}{6}l - \frac{1}{18}l = \frac{l}{9}$

$\therefore \quad l \times b \times h = 216$ [Given]

$\Rightarrow \quad l \times \frac{l}{9} \times \frac{l}{3} = 216 \Rightarrow l = 18$

5. (b) Let, r be the radius of the sphere.

$\therefore \quad \pi \times (8)^2 \times 2 = 12\frac{4}{3} \times \pi \times r^3$

$\Rightarrow \quad r^3 = \frac{128 \times 3}{48} = 8 \Rightarrow r = 2a$

$\Rightarrow$ Diameter of the shpere = 4 cm.

6. (b) Area of the curved surface = $2\pi rh$ = 88.

$\therefore \quad h = 8$. Therefore, $2\pi r = 11$

$\Rightarrow \quad r = \frac{7}{4}$

$\therefore$ Volume = $\pi r^2 h$ = $\frac{22}{7} \times \frac{49}{16} \times 8$ = 77 cm^3.

8. (c) Required number of cubes

$= \left(\frac{15}{3}\right)^3$ = 5 × 5 × 5 = 125.

9. (c) $\left(\sqrt[3]{\frac{27}{64}}\right)^2 = \frac{9}{16}$.

10. (b) $\frac{2 \times 2 \times 5}{3 \times 3 \times 3}$ = 20:27.

11. (b) Here, πr^2 = 1.54 Km^2.

$\therefore \quad r$ = 0.7 Km, l = 2.5 Km (given)

Therefore, $h = \sqrt{l^2 - r^2}$

$= \sqrt{(2.5)^2 - (0.7)^2}$

= 2.4 Km.

12. (b) $\frac{2\pi r^2}{\pi r\sqrt{r^2 + r^2}} = \frac{2}{\sqrt{2}} = \frac{\sqrt{2}}{1}$.

13. (d) $\sqrt[3]{6^3 + 8^3 + 10^3}$

= 12 cm.

14. (c) Here, radius (r) of the cone = $\frac{19.2}{2}$ = 9.6 m.

Slant height (l) of the cone = $\sqrt{(9.6)^2 + (2.8)^2}$ = 10 m.

Hence, area of the canvas required

= πrl = $\frac{22}{7} \times 9.6 \times 10$ = 301.7 m^2.

15. (a) Volume of cuboidal block

= 10 × 5 × 2 = 100 cm^3

Volume of cone carved from the cuboidal block

= $\frac{1}{3} \times \frac{22}{7} \times 1 \times 1 \times 7 = \frac{22}{7}$ cm^3

Wood wasted = 100 − $\frac{22}{7} = \frac{278}{3} = 92\frac{2}{3}$ cm^3

Hence, required % = $92\frac{2}{3}$ %

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16. **(d)** Total volume of three solid metallic balls
$= 3 \times 3 \times 3 + 4 \times 4 \times 4 + 5 \times 5 \times 5$
$= 27 + 64 + 125$
$= 216$ = volume of single solid ball.
Hence, required radius $= \sqrt[3]{216} = 6$ cm.

17. **(b)** Volume of the cuboid
$= 9 \times 8 \times 6 \text{ cm}^3 = 432 \text{ cm}^3$
Volume of the cube $= 216 \text{ cm}^3$
Side of the cube = 6 cm
The total surface area of the cube
$= 6 \times \text{side}^2 = 6 \times 6^2 = 216 \text{ cm}^2$.

18. **(d)** Curved surface of a pillar $= 264 \text{ m}^2$
or, $2\pi rh = 264 \text{ m}^2$
or, $rh = \dfrac{264 \times 7}{2 \times 22}$
$\therefore \quad rh = 42 \text{ m}^2 \quad \ldots(1)$
Again, $\pi r^2 h = 924 \text{ m}^3$
$r^2 h = \dfrac{924}{22} \times 7$
$\therefore \quad r^2 h = 294 \quad \ldots(2)$
Dividing Equation (2) by Equation (1)
$r = 7\ m$
$\therefore \quad h = \dfrac{42}{7} = 6$ m
Hence, required ratio $= 7 \times 2 : 6 = 7:3$.

19. **(d)** $\sqrt{6^2 + 5^2 + 4^2} = \sqrt{77}$

20. **(a)** $\dfrac{\pi \times (3)^2 \times 8}{\pi (0.75)^2 \times 0.2} = 640$.

21. **(a)** $\pi r^2 = 154 \Rightarrow r^2 = \dfrac{154 \times 7}{77} \Rightarrow r = 7$
$\therefore$ The curved surface of the cone
$= \pi rl = \dfrac{22}{7} \times 7 \times \sqrt{7^2 + 14^2}$
$= 22 \times \sqrt{245} = 154\sqrt{5} \text{ cm}^2$.

22. **(b)** Let, $l \times b = 120$, $l \times h = 72$ and $b \times h = 60$.
$\therefore \quad \dfrac{b}{h} = \dfrac{120}{72} = \dfrac{5}{3} \Rightarrow h = 6$
$\therefore \quad l = 12, b = 10, h = 6$
$\therefore$ Volume of the box $= 720 \text{ cm}^3$.

23. **(c)** Volume of circular cone $= \dfrac{1}{3}\pi r^2 h$
or, $\dfrac{1}{3} \times \dfrac{22}{7} \times 24 \times r^2 = 1232$
or, $r^2 = \dfrac{1232 \times 3 \times 7}{22 \times 24} = 22 \times 25 = 550 \text{ cm}^2$.

24. **(d)** Required ratio $= \dfrac{4\pi \times 40 \times 40}{4\pi \times 10 \times 10} = 16:1$.

25. **(c)** Volume of the metal
$= \dfrac{22}{7} \times 21\left[\left(\dfrac{11.2 + 2 \times 0.4}{2}\right)^2 - \left(\dfrac{11.2}{2}\right)^2\right]$
$= 66\ [6^2 - 5.6^2] = 66 \times 11.6 \times 0.4$
$= 306.24 \text{ cm}^3$.

26. **(a)** Volume of the wood
$= [20 \times 12 \times 10] - [(20 - 2)\ (12 - 2)\ (10 - 2)]$
$= 2400 - 1400 = 960 \text{ cm}^3$.

27. **(c)** Volume of iron $= \dfrac{22}{7} \times 20(4^2 - 3^2)$
$= \dfrac{22}{7} \times 20 \times 7 = 440 \text{ cm}^3$.

28. **(c)** Volume of the box $= \sqrt{120 \times 72 \times 60} = 720 \text{ cm}^3$

29. **(a)** Water flowed by the pipe in 1 hr $= \pi r^2 h$
$= \dfrac{22}{7} \times \dfrac{7 \times 7}{100 \times 100} = 5000 \text{ m}^3$
$= 77 \text{ m}^3$
Volume of expected water in the tank
$= \dfrac{50 \times 4 \times 7}{100} = 154 \text{ m}^3$
Hence, required time taken for the rise in the level of water in the tank $= \dfrac{154}{77} = 2$ hours

30. **(d)** Let, the length, breadth and height of the cuboid be x, y and z cm, respectively, then
$xy = 12$; $yz = 20$; $zx = 15$
Therefore, $x^2 y^2 z^2 = 12 \times 12 \times 15 = 3600 \text{ cm}^6$
Hence, $v = xyz = \sqrt{3600}$
$v = 60 \text{ cm}^3$

31. **(b)** Water flowed through the pipe in 1 hours
$= \dfrac{22}{7} \times \dfrac{10 \times 10 \times 3000}{10000}$
$= \dfrac{660}{7} \text{ m}^3$
Volume of cylinder/cylindrical cistern
$= \dfrac{22}{7} \times 5 \times 5 \times 2$
$= \dfrac{1100}{7} \text{ m}^3$
Hence, required time
$= \dfrac{\frac{1100}{7}}{\frac{660}{7}} = \dfrac{5}{3}$ hours
= 1 hour 40 minute

32. **(b)** Volume of raised water in the cylindrical leaker
$\pi r^2 h = \dfrac{22}{7} \times \dfrac{7}{2} \times \dfrac{7}{2} \times 5.6$
$= 215.6 \text{ cm}^3$

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

$= \frac{4}{3}\times\frac{22}{7}\times(0.7)^3 = \frac{4.312}{3}$ cm^3

Hence, number of marbles

$= \frac{\frac{215.6}{\frac{4.312}{3}}}{} = \frac{215.6\times 3}{4.312} = 150$

33. **(b)** Let, the radius of base of the hemisphere be r units. Then, radius of the base of cone = r units and height = r units.

Therefore, slant height (l)

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

Hence, the curved surface area of the hemisphere: The curved surface area of the cone

$= 2\pi r^2 : \pi r \times \sqrt{2}r = 2:\sqrt{2}$

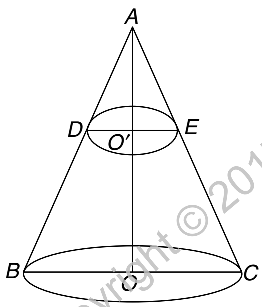
34. **(d)** Let, the side of cube is x, then volume of the cube $= x^3$

One side of the cube after increasing = $2x$.

$\therefore$ Required % increase of volume

$= \frac{x\times x\times 2x - x^3}{x^3}\times 100 = 100\%$

35. **(b)** Let, H and R be the height and radius of bigger cone and h and r be the height and radius of smaller cone.



From triangles AOB and AMN.

$\angle A$ is common and $MN \parallel OB$.

$\therefore$ Triangles AOB and AMN are similar,

$\therefore \frac{AO}{AM} = \frac{BO}{MN}$

$\Rightarrow \frac{30}{h} = \frac{R}{r}$ …(1)

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

Volume of bigger cone $= \frac{1}{3}\pi R^2 H$

$\therefore$ Now, according to the question,

$\Rightarrow \frac{1}{3}\pi r^2 h = \left(\frac{1}{3}\pi R^2 H\right)\times\frac{1}{27}$

$\Rightarrow r^2 h = \frac{R^2 H}{27}$

$\Rightarrow 27r^2 h = R^2 H$

$\Rightarrow \frac{27h}{H} = \frac{R^2}{r^2}$

$\Rightarrow \frac{27h}{H} = \left(\frac{30}{h}\right)^2$ [From (1)]

$\Rightarrow \frac{27h}{H} = \frac{900}{h^2}$

$\Rightarrow 27h^3 = 900H = 900\times 30$

$\Rightarrow h^3 = \frac{900\times 30}{27} = 1000$

$\Rightarrow h = \sqrt[3]{1000} = 10$ cm

$\therefore$ Required height = (30 − 10) = 20 cm

36. **(c)** Surface area of sphere = $4\pi r^2$

Now, according to the question,

$4\times\frac{22}{7}\times r^2 = 346.5$

$\Rightarrow 4\times 22\times r^2 = 346.5\times 7$

$\Rightarrow r^2 = \frac{346.5\times 7}{4\times 22} = 27.5625$

$\Rightarrow r = \sqrt{27.5625} = 5.25$ cm

37. **(a)** Volume of pyramid $= \frac{1}{3}\times$ Area of base $\times$ Height

$\Rightarrow 500 = \frac{1}{3}\times 30\times h$

$\Rightarrow 10h = 500$

$\Rightarrow h = \frac{500}{10} = 50$ m

38. **(c)** Hypotenuse of base $= \sqrt{5^2+12^2}$

$= \sqrt{25+144} = \sqrt{169} = 13$ cm

$\therefore$ Surface area = $h(a + b + c)$

= 10 (5 + 2 + 13) = 300 cm^2

Area of base $= \left(\frac{1}{2}\times 5\times 12\right) = 30$ cm^2

$\therefore$ Total surface area of lateral surfaces = (300 + 30) = 330 cm^2

39. **(a)** Lateral surface area of prism = 3 × side × height

$\therefore$ 3 × side × height = 120

$\Rightarrow$ Side × height $= \frac{120}{3} = 40$ cm^2 …(1)

Volume of prism = Area of base × height

$\Rightarrow 40\sqrt{3} = \frac{\sqrt{3}}{4}\times \text{side}^2\times\text{height}$

$\Rightarrow \frac{40\sqrt{3}\times 4}{\sqrt{3}} = \text{side}^2\times\text{height}$

$\therefore$ side^2 × height = 160 cm^3 …(2)

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Dividing equation (2) by (1), we get

$\text{Side} = \frac{160}{40} = 4 \text{ cm}$

40. **(d)** Volume of lead $= \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times 2^3$

Let, the thickness of gold be x cm.

$\therefore$ Volume of gold $= \frac{4}{3}\pi((2+x)^3 - 2^3)$ cm^3

Now, according to the question,

$\frac{4}{3}\pi((2+x)^3 - 2^3) = \frac{4}{3}\pi \times 2^3$

$\Rightarrow \quad (2+x)^3 - 2^3 = 2^3$

$\Rightarrow \quad (2+x)^3 = 8 + 8 = 16$

$\Rightarrow \quad (2+x)^3 = 2^3 \times 2$

$\Rightarrow \quad 2 + x = 2 \times \sqrt[3]{2}$

$\Rightarrow \quad 2 + x = 2 \times 1.259 = 2.518$

$\therefore \quad x = 2.518 - 2 = 0.518$ cm

41. **(d)** Let, the radius of larger sphere be R units

$\therefore$ Its volume $= \frac{4}{3}\pi R^3$ cu units

Volume of smaller cone $= \frac{1}{3}\pi R^3$ cubic units

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

[Where, r = radius of smaller sphere]

Now, according to the question,

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

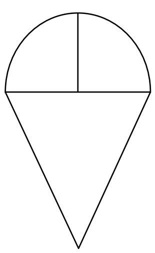
$\Rightarrow \quad r^3 = \frac{R^3}{4} \quad \Rightarrow \quad r = \frac{R}{\sqrt[3]{4}}$

$\therefore$ Surface area of smaller sphere:Surface area of larger sphere = $4\pi r^2 : 4\pi R^2 = r^2 : R^2$

$= \left(\frac{R}{\sqrt[3]{4}}\right)^2 : R^2 = 1 : \left(\sqrt[3]{4}\right)^2$

$= 1 : \left((2^2)^{\frac{1}{3}}\right)^2 = 1 : 2^{\frac{4}{3}}$

42. **(a)**



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

where r = radius = 7 cm

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

Volume of conical part $= \frac{1}{3}\pi r^2 h \quad [\because r = h]$

$= \left(\frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 7\right)$ cm^3

$\therefore$ Volume of ice cream

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

$= \frac{22}{7} \times 7^3 = 22 \times 7^2 = 1078$ cm^3

43. **(c)** Quicker Method:

Single equivalent increase for 10% and 10%

$= \left(10 + 10 + \frac{10 \times 10}{100}\right)\% = 21\%$

Again, single equivalent increase for 21% and 10%

$= \left(21 + 10 + \frac{21 \times 10}{100}\right)\%$

$= 31 + 2.1 = 33.1\%$

44. **(c)** Volume of the cone $= \frac{1}{3}\pi r^2 h = \frac{\pi}{3} \times 1.6 \times 1.6 \times 3.6$

$= \pi \times 1.6 \times 1.6 \times 1.2$ cm^3

Now, according to the question,

$\frac{1}{3}\pi \times 1.2 \times 1.2 \times H = \pi \times 1.6 \times 1.6 \times 1.2$

$\therefore \quad H = \frac{1.6 \times 1.6 \times 3}{1.2} = 6.4$ cm

45. **(d)** Radius of the base of cone = r units

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

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

$\therefore \quad 3\pi v h^3 - c^2 h^2 + 9v^2 = 3\pi \times \frac{1}{3}\pi r^2 h \times h^3$

$-\pi^2 r^2 (h^2 + r^2) h^2 + 9 \times \frac{1}{9}\pi^2 r^4 h^3$

$= \pi^2 r^2 h^4 - \pi^2 r^2 h^4 - \pi^2 r^4 h^2 + \pi^2 r^4 h^2 = 0$

46. **(d)** $\pi r^2 = 154$

$\Rightarrow \quad \frac{22}{7} \times r^2 = 154$

$\Rightarrow \quad r^2 = \frac{154 \times 7}{22} \quad \Rightarrow \quad r = 7$ m

$\therefore \quad \frac{1}{2}\pi r^2 h = 1232$

$\Rightarrow \quad \frac{h}{3} = \frac{1232}{154} = 8 \quad \Leftrightarrow \quad h = 24$ m

Area of canvas $= \pi r l = \pi r\sqrt{h^2 + r^2}$

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$= \frac{22}{7} \times 7 \times \sqrt{24^2 + 7^2}$ m^2

$= 22 \times 25 = 550$ m^2

$\Rightarrow$ Its length $= \left(\frac{550}{2}\right) = 275$ metres

47. **(d)** Let, the height of glass be h cm.

$\therefore$ Radius $= \frac{h}{2}$ cm

Volume of glass = volume of 32000 drops

$\therefore \frac{1}{3}\pi\left(\frac{h}{2}\right)^2 \times h = \frac{4}{3}\pi\left(\frac{1}{20}\right)^3 \times 32000$

$\Rightarrow \frac{h^3}{4} = 4 \times \frac{1}{8000} \times 32000 \quad \Leftrightarrow \quad h^3 = 4^3 \quad \Rightarrow \quad h = 4$ cm

48. **(a)** Volume of the rectangular block = 11 × 10 × 5 = 550 cu m = 550000 cu dm

Volume of a sphere $= \frac{4}{3}\pi \times \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2}$ cu dm $= \frac{500}{8}$ cu dm

$\therefore$ Required answer $= \frac{550000 \times 8}{500} = 8800$

49. **(a)** Volume of the block = 21 × 77 × 24 cm^3

Let, the radius of sphere be r cm.

Now, according to the question,

$\frac{4}{3}\pi r^3 = 21 \times 77 \times 24$

$\Rightarrow r^3 = \frac{21 \times 77 \times 24 \times 3 \times 7}{4 \times 22}$

$= 21 \times 7 \times 3 \times 3 \times 7 = 3^3 \times 7^3$

$\therefore r = 3 \times 7 = 21$ cm

50. **(a)** Let, the radius of cone be r cm.

Now, according to the question,

$\frac{1}{3} \times \frac{22}{7} \times r^2 \times 24 = 1232$

$\therefore r^2 = \frac{1232 \times 3 \times 7}{22 \times 24} = 49$

$\therefore r = \sqrt{49} = 7$ cm

$\therefore$ Area of the curved surface $= \pi rl = \pi r\sqrt{h^2 + r^2}$

$= \frac{22}{7} \times 7\sqrt{24^2 + 7^2} = 22 \times 25 = 550$ cm^2

51. **(a)** Quicker Method:

Required percentage increase

$= \left(50 + 50 + \frac{50 \times 50}{100}\right)\% = 125\%$

52. **(c)** $\frac{4\pi r_1^2}{4\pi r_2^2} = \frac{4}{9} \quad \Rightarrow \quad \frac{r_1}{r_2} = \frac{2}{3}$

$\therefore \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$

53. **(d)** Quicker Method:

Percentage increase $= \left(50 + 50 + \frac{50 \times 50}{100}\right)\%$

= 125%

54. **(d)** Volume of the sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \pi \times 9 \times 9 \times 9$

= 972π cu cm

Let, the radius of the wire be R cm.

Now, according to the question, $\pi R^2 \times 10800 = 972p$

$\Rightarrow R^2 = \frac{972}{10800} = 0.09$

$\therefore R = \sqrt{0.09} = 0.3$ cm

$\therefore$ Diameter = 2 × 0.3 = 0.6 cm

55. **(b)** If the radius of the base of cup be r cm, then $2\pi r = \pi \times 14$

$\Rightarrow r = 7$ cm

Slant height = 14 cm

$\therefore$ Height $= \sqrt{14^2 - 7^2} = \sqrt{21 \times 7} = 7\sqrt{3}$ cm

$\therefore$ Capacity of cup $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 7\sqrt{3} = 622.36$ cm^3.

56. **(a)** $S = 4\pi r^2$ and $V = \frac{4}{3}\pi r^3$

$\therefore \frac{S^3}{V^2} = \frac{64\pi^3 r^6}{\frac{16}{9}\pi^2 r^6} = \frac{64\pi \times 9}{16} = 36\pi$

57. **(d)** Volume of the sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3}\pi$ cm^3

Volume of the wire = $\pi r^2 h$ = $100\pi r^2$ cm^3

Now, according to the question

$100\pi r^2 = \frac{4}{3}\pi$

$\Rightarrow r^2 = \frac{4}{300} = \frac{1}{75}$

$\therefore r = \sqrt{\frac{1}{75}} = 0.11$ cm

58. **(c)** Volume of the earth taken out

= (7.5 × 6 × 0.8) cm^3

= 36 cm^3

Area of the remaining field

= (18 × 15 – 7.5 × 6) m^2

= (270 – 45) m^2

= 225 m^2

$\therefore$ Level of the field raised $= \frac{36}{225}$ metres

$= \frac{3600}{225}$ cm $= 16$ cm

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59. **(c)** Area of the base $=\left(\frac{\sqrt{3}}{4}\times 4^2\right)=4\sqrt{3}\text{ cm}^2$

Median of the base $=\left(\sqrt{4^2-2^2}\right)=2\sqrt{3}\text{ cm}^2$

Distance of centroid from the side $=\frac{2\sqrt{3}}{3}$ cm

Let, the height of the pyramid be h cm.

Now, according to the question,

$\therefore \quad \sqrt{(2h)^2-h^2}=\frac{2\sqrt{3}}{3}$

$\Rightarrow \quad \sqrt{3}h=\frac{2\sqrt{3}}{3}$

$\Rightarrow \quad h=\frac{2}{3}$ cm

$\therefore \quad \text{Volume}=\frac{1}{3}\times\text{Area of base}\times\text{height}$

$=\frac{4\sqrt{3}\times 2}{3\times 3}=\frac{8\sqrt{3}}{9}\text{ cm}^3$

60. **(a)** 15 Km/h = 15000 m/hour

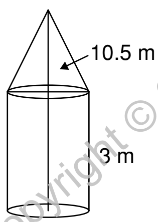
Water flown in an hour $=\frac{2\times 1.5\times 15000}{100}$

= 450 m^3

Volume of desired water in the tank = (150 × 100 × 3) m^3

$\therefore \quad \text{Time}=\frac{150\times 100\times 3}{450}=100\text{ hours}$

61. **(c)**



Slant height of cone $(l)=\sqrt{(10.5)^2+14^2}$.

$=\sqrt{110.25+196}=\sqrt{306.25}=17.5\text{ m}$

Curved surface area of the cone

$=\pi rl=\frac{22}{7}\times 14\times 17.5=770\text{ m}^2$

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

$=2\times\frac{22}{7}\times 14\times 3=264\text{ m}^2$

$\therefore$ Total area = 264 + 770 = 1034 m^2

$\therefore$ Total cost = 2 × 1034 = ₹2068

62. **(c)** Quicker Method:

Percentage decrease $=\left(2x-\frac{x^2}{100}\right)^2\%$

$=(50-6.25)\%=43.75\%$

63. **(a)** Let, the radius be increased by x cm.

$\therefore$ Volume of cylinder = $\pi(10+x)^2\times 4$

Again, let the height be increased by x cm.

$\therefore$ Volume of cylinder = $\pi\times 10^2\,(4+x)$

Now, according to the question,

$\pi(10+x)^2\times 4=\pi(10)^2\,(4+x)$

$\Rightarrow \quad (10+x)^2=25\,(4+x)$

$\Rightarrow \quad 100+20x+x^2=100+25x$

$\Rightarrow \quad x^2-5x=0$

$\Rightarrow \quad x(x-5)=0$

$\Rightarrow \quad x=5$ cm

64. **(c)** Let, the radius and height of the cone be r CM and h cm respectively.

Now, according to the question,

Required volume of water

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

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

= 2 × volume of cone

= (2 × 27π) = 54π cm^3

Quicker Method:

Volume of required water = 2 × volume of cone

= 2 × 27π = 54π cm^3

65. **(b)** Volume of rain water = Area of base × height

$=1000000\times\frac{2}{100}=20000\text{ cm}^3$

Water stored in pool

= (50% of 20000) = 10000 cm^3

$\therefore$ Required water level $=\left(\frac{10000}{1000}\right)=10\text{ m}$

66. **(c)** Let, the radius of the base be r = 3.5.

Now, volume of the water in the cylindrical can

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

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

[Here, $2r$ = height of the cylindrical can]

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

Again, let the height of water in the cylindrical can be h cm.

Therefore, according to the question,

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

$\Rightarrow \quad h=\frac{\frac{2}{3}\pi r^3}{\pi r^2}=\frac{2}{3}r=\frac{2\times 3.5}{3}=\frac{7}{3}\text{ cm}$

Quicker Method: Increase in water level

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$$= \frac{\text{Volume of sphere}}{\text{Area of base of cylinder}} = \frac{\frac{4}{3}\pi r^3}{\pi r^2}$$

$$= \left(\frac{4}{3}r = \frac{4}{3} \times 3.5\right) = \frac{14}{3} \text{ cm}$$

$\therefore$ Required water level $= \left(7 - \frac{14}{3}\right) = \frac{7}{3}$ cm

67. **(a)** Curved surface of cylinder = $2\pi rh$

Case II:

Radius $= \frac{1}{3}r$ and height = $6h$

Curved surface $= 2\pi \times \frac{1}{3}r \times 6h = (2\pi rh) \times 2$

$\therefore$ Increase in curved surface of cylinder will be twice.

68. **(b)** Let, the radius of the given cone be r cm

Then, $\frac{1}{3}\pi r^2 h = 1232$

$\Rightarrow \frac{1}{3} \times \frac{22}{7} \times r^2 \times 24 = 1232$

$\Rightarrow r^2 = \frac{1232 \times 3 \times 7}{22 \times 24} = 49$

$\therefore r = \sqrt{49} = 7$ cm

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

$= \sqrt{24^2 + 7^2} = \sqrt{625} = 25$ cm

$\therefore$ Curved surface of cone = πrl

$= \left(\frac{22}{7} \times 7 \times 25\right) = 550 \text{ cm}^2$

69. **(c)** Total surface area of prism = Curved surface area + 2 × Area of base

$\Rightarrow$ 608 = Perimeter of base× height + 2 × Area of base

$\Rightarrow$ 608 = $4x \times 15 + 2x^2$

(Where x = side of square)

$\Rightarrow x^2 + 30x - 304 = 0$

$\Rightarrow x^2 + 38x - 8x - 304 = 0$

$\Rightarrow x(x + 38) - 8(x + 38) = 0$

$\Rightarrow (x - 8)(x + 38) = 0$

$\Rightarrow x = 8$

Volume of prism = Area of base × height

= 8 × 8 × 15 = 960 cm^3

70. **(a)** $\frac{2}{3}\pi r^2 = 19404$

$\Rightarrow \frac{2}{3} \times \frac{22}{7} \times r^3 = 19404$

$\Rightarrow r^3 = \frac{19404 \times 3 \times 7}{2 \times 22} = 9261$

$\therefore r = \sqrt[3]{21 \times 21 \times 21} = 21$ cm.

$\therefore$ Total surface area = πr^2

$= 3 \times \frac{22}{7} \times 21 \times 21$

= 4158 cm^2

71. **(c)** Height of cone = height of cylinder = radius of hemisphere = r units

$\therefore$ Ratio of the volumes of cone, cylinder and hemisphere

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

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

$= \frac{4}{3} : 9 : \frac{2}{3} = 4:27:2$

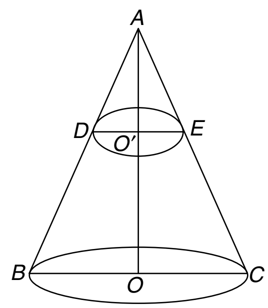
72. **(c)** Area of the base $= \frac{1}{2} \times (\text{diagonal})^2$

$= \frac{1}{2} \times 24\sqrt{2} \times 24\sqrt{2} = 576 \text{ m}^2$

$\therefore$ Volume of pyramid $= \frac{1}{3} \times$ height $\times$ area of base

$= 1728 = \frac{1}{3} \times h \times 576 \Rightarrow h = \frac{1728 \times 3}{576} = 9$ m

73. **(b)**



Let, $DO' = r$ cm and $OO' = h$ cm

From similar triangle ADO' and ABO $\frac{AO}{AO} = \frac{DO}{BO}$

$\Rightarrow \frac{9 - h}{9} = \frac{r}{3}$

$\Rightarrow 9 - h = 3r$

$\Rightarrow h = 9 - 3r$

Volume of frustum $= \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$

$\Rightarrow 44 \frac{1}{3} \times \frac{22}{7}(9 - 3r)(9 + r^2 + 3r)$

$\Rightarrow 44 = \frac{22}{7}(3 - r)(3^2 + 3r + r^2)$

$\Rightarrow \frac{44 \times 7}{22} = 3^3 - r^3 = 14 = 27 - r^3$

$\Rightarrow r^3 = 27 - 14 = 13$

$\therefore r = \sqrt[3]{13}$ cm

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74. **(a)**

First cylinder	Second cylinder
$r_1 = 2r$	$r_2 = 3r$
$h_1 = 5h$	$h_2 = 4h$

$\therefore$ Required ratio $= 2\pi r_1 h_1 : 2\pi r_2 h_2$

$= 2\times 5 : 3\times 4 = 5:6$

75. **(c)** Let, the height of cylinder be h cm and radius of base be r cm.

Now, according to the question,

$2\pi r^2 + 2\pi rh = 462$ ...(1)

Area of curved surfaces = $2\pi rh$

$= \frac{1}{3}\times 462 = 154$

$\therefore\ 2\pi r^2 + 154 = 462$

$\Rightarrow\ 2\pi r^2 = 462 - 154 = 308$

$\Rightarrow\ 2\times\frac{22}{7}\times r^2 = 308$

$\Rightarrow\ r^2 = \frac{308\times 7}{2\times 22} = 49$

$\Rightarrow\ r = 7$ cm

$\therefore\ 2\pi rh = 154$

$\Rightarrow\ 2\times\frac{22}{7}\times 7\times h = 154$

$\Rightarrow\ h = \frac{154}{2\times 22} = \frac{7}{2}$ cm

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

$= \frac{22}{7}\times 7\times 7\times\frac{7}{2} = 539\ \text{cm}^3$

76. **(d)** Let, the radius and the height be r and h respectively.

$\frac{\text{Curved surface of cylinder}}{\text{curved surface of cone}} = \frac{8}{5}$

$\Rightarrow\ \frac{2\pi rh}{\pi r\sqrt{h^2+r^2}} = \frac{8}{5}$

$\Rightarrow\ \frac{h}{\sqrt{h^2+r^2}} = \frac{4}{5}$

On squaring both sides, we have

$\frac{h^2}{h^2+r^2} = \frac{16}{25}$

$\Rightarrow\ \frac{h^2+r^2}{h^2} = \frac{25}{16}\ \Rightarrow\ 1+\frac{r^2}{h^2} = \frac{25}{16}$

$\Rightarrow\ \frac{r^2}{h^2} = \frac{25}{16} - 1 = \frac{9}{16}\ \Rightarrow\ \frac{r}{h} = \frac{3}{4}$

$r:h = 3:4$

77. **(d)** Let, the radius of base = r units and the height of cone = h units.

Now, according to the question,

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

$\Rightarrow\ 2r = \sqrt{r^2+h^2} = 4r^2 = r^2 + h^2$

$\Rightarrow\ 3r^2 = h^2\ \Rightarrow\ \sqrt{3}r = h$

$\Rightarrow\ \frac{r}{h} = \frac{1}{\sqrt{3}}\qquad \therefore\ r:h = 1:\sqrt{3}$

78. **(d)** Area of the base $= \frac{\sqrt{3}}{4}\times \text{side}^2$

$= \frac{\sqrt{3}}{4}\times 6\times 6 = 9\sqrt{3}\ \text{cm}^2$

$\therefore$ Volume of the prism = Area of base × height

$\Rightarrow\ 108\sqrt{3} = 9\sqrt{3}\times h$

$\Rightarrow\ h = \frac{108\sqrt{3}}{9\sqrt{3}} = 12$ cm.

79. **(a)** Let, the number of required coins be x.

Total volume of all coins

$= x\times\pi\times(0.75)^2\times(0.2)$

Volume of cylinder $= \pi\times(3)^2\times 8$

Now, according to the question,

$x\times\pi\times(0.75)^2\times(0.2) = \pi\times(3)^2\times 8$

$x = \left(\frac{3}{0.75}\right)^2\times\left(\frac{8}{0.2}\right) = 4^2\times 40$

= 16 × 40 = 640

Quicker Method:

Number of coins $= \left(\frac{R_2}{R_1}\right)^2\times\left(\frac{h_2}{h_1}\right)$

$= \left(\frac{3}{0.75}\right)^2\times\left(\frac{8}{0.2}\right) = 4^2\times 40 = 640$

80. **(d)** Let, the radius of the original sphere be rm

New radius = $(r + 2)$ m

Now, according to the question,

$4\pi(r+2)^2 - 4\pi r^2 = 704\ \text{m}^2$

$\Rightarrow\ 4\pi(r^2 + 4r + 4 - r^2) = 704\ \text{m}^2$

$\Rightarrow\ 16\pi(r + 1) = 704\ \text{m}^2$

$\Rightarrow (r+1) = \frac{704}{16\pi} = \frac{44\times 7}{22} = 14$ m

$\therefore\ r = 14 - 1 = 13$ m

81. **(c)** Here,a right circular cylinder is circumscribing a hemisphere such that their bases are common.

Then, Radius of cylinder = Radius of hemisphere = height of cylinder = r

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

Volume of cylinder = $pr^2.r = \pi.r^3$

$\therefore$ Required ratio $= \frac{2}{3}:1 = 2:3$

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82. **(c)** Total volume of three spherical balls

$$= \frac{4}{3}\pi[(1)^2 + (2)^3 + (3)^3] = \left[\frac{4}{3}\pi \times 36\right]\text{cm}^3$$

Wasted material $= \frac{4}{3}\pi \times 36 \times \frac{25}{100}\ \text{cm}^3$

$$= \frac{4}{3}\pi \times 9\ \text{cm}^3$$

$\therefore$ Remaining material $= \frac{4}{3}\pi \times (36 - 9)$

$$= \frac{4}{3}\pi \times 27 = \frac{4}{3}\pi 3^3\ \text{cm}^3$$

$\therefore$ Required radius = 3 cm

[$\because$ Volume of sphere $= \frac{4}{3}\pi 3^3$]

83. **(b)** The length of the diagonal of a cube = 6 cm

$\therefore$ $\text{Side} \times \sqrt{3} = 6\ \text{cm}$

$$\Rightarrow \text{Side} = \frac{6}{\sqrt{3}} = 2\sqrt{3}\ \text{cm}$$

$\therefore$ $\text{Volume} = (2\sqrt{3})^3 = 24\sqrt{3}\ \text{cm}^3$

84. **(c)** Total curved surface area of all four identicalparts = $4\pi r^2$ unit^2

Here, there will be eight plane surfaces infour identical parts.

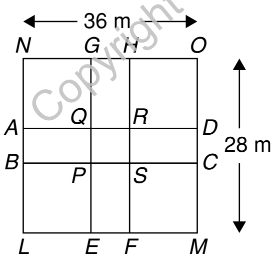
Hence, total plane surface area of four parts

$$= 8 \times \frac{1}{2}\pi r^2 = 4\pi r^2\ \text{unit}^2$$

$\therefore$ Total surface area of four parts

$= 4\pi r^2 + 4\pi r^2 = 8\pi r^2$ unit^2

85. **(e)**



Area of rectangular plot LMNO= 36 × 28 =1008 m^2

Area of paths = Area of ABCD + Area of EFGH − Area of PQRS

= (36 × 5 + 28 × 5) – 5 × 5 = 180 + 140 − 25 = 295 m^2

Area of rectangular plot excluding the area covered by roads = 1008 – 295 =713.

Now, total cost of gravelling the plot = 713 × 3.60 = ₹2566.80

86. **(c)** Here the edge of an ice cube is 14 cm.

Radius of the cylinder $= \frac{14}{2} = 7\ \text{cm}$

Height of the cylinder = 14 cm

$\therefore$ Volume of the largest cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times 7 \times 7 \times 14 = 2156\ \text{cm}^3$$

87. **(c)** Total flooring area with marble

= locker area + record keeping + pantry

= 182 + 273 + 609 = 1064 m^2

Cost of flooring = 1064 × 190

Total flooring area with wood

= Branch manager's room + hall = 221 + 667 = 888 m^2

Cost of flooring = 888 × 170

Ratio = (888 × 170):(1064 × 190)

= (888 × 17):(1064 × 19)

= 15096:20216

= 1887:2527

88. **(e)** Cost of flooring of the branch manager's room = 221 × 170 = ₹37570

Cost of painting

$$= [2(17 \times 12 + 13 \times 12) + 13 \times 17] \times 190$$

$$= [2(204 + 156) + 221] \times 190 = (2 \times 360 + 221) \times 190$$

$$= (720 + 221) \times 190 = 941 \times 190 = ₹178790$$

Total cost = 178790 + 37570 = ₹216360

89. **(e)** Total area of the bank = 2000 m^2

Total floor area = 1952 m^2

Remaining area = 2000 – 1952 = 48 m^2

$\therefore$ Cost of carpeting = 48 × 110 = ₹5280

90. **(b)** Area not to be renovated = 48 m^2

$\therefore$ $\text{Required\%} = \frac{48}{2000} \times 100 = 2.4\%$

91. **(a)** Cost of renovation of hall + locker area = 667 × 170 + 609 × 190

= 113390 + 115710 = ₹229100

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