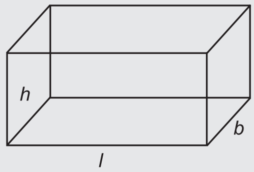
25 Volume and Surface Areas

IMPORTANT FORMULAE

I. Cuboid

Let length = l, breadth = b and height = h units. Then,

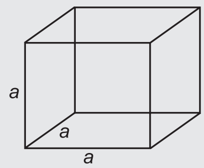
1. **Volume** = $(l \times b \times h)$ cubic units.
2. **Surface area** = $2\,(lb + bh + lh)$ sq. units.
3. **Diagonal** = $\sqrt{l^2 + b^2 + h^2}$ units.



II. Cube

Let each edge of a cube be of length a. Then,

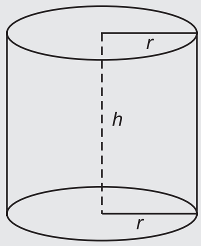
1. **Volume** = a^3 cubic units.
2. **Surface area** = $6a^2$ sq. units.
3. **Diagonal** = $\sqrt{3}\,a$ units.



III. Cylinder

Let radius of base = r and Height (or length) = h. Then,

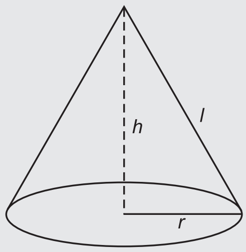
1. **Volume** = $(\pi r^2 h)$ cubic units.
2. **Curved surface area** = $(2\pi rh)$ sq. units.
3. **Total surface area** = $(2\pi rh + 2\pi r^2)$ sq. units
$= 2\pi r\,(h + r)$ sq. units.



IV. Cone

Let radius of base = r and Height = h. Then,

1. **Slant height,** $l = \sqrt{h^2 + r^2}$ units.
2. **Volume** = $\left(\frac{1}{3}\pi r^2 h\right)$ cubic units.
3. **Curved surface area** = (πrl) sq. units.
4. **Total surface area** = $(\pi rl + \pi r^2)$ sq. units.

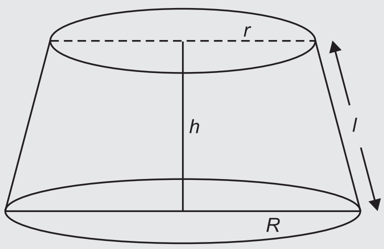


V. Frustum of a Cone

When a cone is cut by a plane parallel to the base of the cone then the portion between the plane and the base is called the frustum of the cone.

Let radius of base = R, radius of top = r, and height = h. Then,

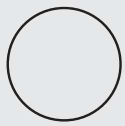
1. **Volume** = $\frac{\pi h}{3}(R^2 + r^2 + Rr)$ cubic units.
2. **Slant height,** l = $\sqrt{(R - r)^2 + h^2}$ units.
3. **Lateral (or curved) surface area** = $\pi.l\,(R + r)$ sq. units.
4. **Total surface area** = $\pi\,[R^2 + r^2 + 1\,(R + r)]$ sq. units.



VI. Sphere

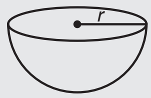
Let the radius of the sphere be r. Then,

1. **Volume** = $\left(\frac{4}{3}\pi r^3\right)$ cubic units.
2. **Surface area** = $(4\pi r^2)$ sq. units.



VII. Hemisphere

Let the radius of a hemisphere be r. Then,



1. **Volume** = $\left(\frac{2}{3}\pi r^3\right)$ cubic units.
2. **Curved surface area** = $(2\pi r^2)$ sq. units.
3. **Total surface area** = $(3\pi r^2)$ sq. units.

VIII. Pyramid

1. **Volume** = $\frac{1}{3} \times \text{area of base} \times \text{height}$.
2. **Whole surface area** = Area of base + Area of each of the lateral faces

Remember : 1 litre = 1000 cm^3.

SOLVED EXAMPLES

Ex. 1. *Find the volume and surface area of a cuboid 16 m long, 14 m broad and 7 m high.*

Sol. Volume = $(16 \times 14 \times 7)\ m^3 = 1568\ m^3$.

Surface area = $[2\ (16 \times 14 + 14 \times 7 + 16 \times 7)]\ cm^2 = (2 \times 434)\ cm^2 = 868\ cm^2$.

Ex. 2. *A room is 12 metres long, 9 metres broad and 8 metres high. Find the length of the longest bamboo pole that can be placed in it.* **(P.C.S., 2008)**

Sol. Length of the longest pole = Length of the diagonal of the room

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

Ex. 3. *The volume of a wall, 5 times as high as it is broad and 8 times as long as it is high, is 12.8 cu. metres. Find the breadth of the wall.*

Sol. Let the breadth of the wall be x metres.

Then, Height = $5x$ metres and Length = $40x$ metres.

$\therefore\ x \times 5x \times 40x = 12.8 \Leftrightarrow x^3 = \frac{12.8}{200} = \frac{128}{2000} = \frac{64}{1000}$.

So, $x = \frac{4}{10}\ \text{m} = \left(\frac{4}{10} \times 100\right)\ \text{cm} = 40\ \text{cm}$.

Ex. 4. *Find the number of bricks, each measuring 24 cm × 12 cm × 8 cm, required to construct a wall 24 m long, 8m high and 60 cm thick, if 10% of the wall is filled with mortar?* **(M.B.A., 2010)**

Sol. Volume of the wall = $(2400 \times 800 \times 60)$ cu. cm.

Volume of bricks = 90% of the volume of the wall

$= \left(\frac{90}{100} \times 2400 \times 800 \times 60\right)$ cu. cm.

Volume of 1 brick = $(24 \times 12 \times 8)$ cu. cm.

$\therefore$ Number of bricks = $\left(\frac{90}{100} \times \frac{2400 \times 800 \times 60}{24 \times 12 \times 8}\right) = 45000$.

Ex. 5. *A rectangular sheet of paper, 10 cm long and 8 cm wide has squares of side 2 cm cut from each of its corners. The sheet is then folded to form a tray of depth 2 cm. Find the volume of this tray.* **(R.R.B., 2006)**

Sol. Clearly, we have:

Length of the tray = $(10 - 2 \times 2)$ cm = 6 cm.

Breadth of the tray = $(8 - 2 \times 2)$ cm = 4 cm.

Depth of the tray = 2 cm.

$\therefore$ Volume of the tray = $(6 \times 4 \times 2)\ cm^3 = 48\ cm^3$.

Ex. 6. *Water flows into a tank 200 m × 150 m through a rectangular pipe 1.5 m × 1.25 m @ 20 kmph. In what time (in minutes) will the water rise by 2 metres?*

Sol. Volume required in the tank = $(200 \times 150 \times 2)\ m^3 = 60000\ m^3$.

Length of water column flown in 1 min. $= \left(\frac{20 \times 1000}{60}\right)$ m $= \frac{1000}{3}$ m.

Volume flown per minute $= \left(1.5 \times 1.25 \times \frac{1000}{3}\right)$ m^3 = 625 m^3.

$\therefore$ Required time $= \left(\frac{60000}{625}\right)$ min. = 96 min.

Ex. 7. ***The dimensions of an open box are 50 cm, 40 cm and 23 cm. Its thickness is 3 cm. If 1 cubic cm of metal used in the box weighs 0.5 gms, find the weight of the box.***

Sol. Volume of the metal used in the box = External volume − Internal volume
= [(50 × 40 × 23) − (44 × 34 × 20)] cm^3
= 16080 cm^3.

$\therefore$ Weight of the metal $= \left(\frac{16080 \times 0.5}{1000}\right)$ kg = 8.04 kg.

Ex. 8. ***The diagonal of a cube is $6\sqrt{3}$ cm. Find its volume and surface area.***

Sol. Let the edge of the cube be a.

$\therefore \sqrt{3}\,a = 6\sqrt{3} \Rightarrow a = 6.$

So, Volume = a^3 = (6 × 6 × 6) cm^3 = 216 cm^3.

Surface area = $6a^2$ = (6 × 6 × 6) cm^2 = 216 cm^2.

Ex. 9. ***The surface area of a cube is 1734 sq. cm. Find its volume.***

Sol. Let the edge of the cube be a. Then,

$6a^2 = 1734 \Rightarrow a^2 = 289 \Rightarrow a = 17$ cm.

$\therefore$ Volume = a^3 = $(17)^3$ cm^3 = 4913 cm^3.

Ex. 10. ***A rectangular block 6 cm by 12 cm by 15 cm is cut up into an exact number of equal cubes. Find the least possible number of cubes.***

Sol. Volume of the block = (6 × 12 × 15) cm^3 = 1080 cm^3.

Side of the largest cube = H.C.F. of 6 cm, 12 cm, 15 cm = 3 cm.

Volume of this cube = (3 × 3 × 3) cm^3 = 27 cm^3.

Number of cubes $= \left(\frac{1080}{27}\right) = 40.$

Ex. 11. ***A cube of edge 15 cm is immersed completely in a rectangular vessel containing water. If the dimensions of the base of vessel are 20 cm × 15 cm, find the rise in water level.*** **(R.R.B., 2003)**

Sol. Increase in volume = Volume of the cube = (15 × 15 × 15) cm^3.

$\therefore$ Rise in water level $= \left(\frac{\text{Volume}}{\text{Area}}\right) = \left(\frac{15 \times 15 \times 15}{20 \times 15}\right)$ cm = 11.25 cm.

Ex. 12. ***Three solid cubes of sides 1 cm, 6 cm and 8 cm are melted to form a new cube. Find the surface area of the cube so formed.*** **(Bank P.O., 2009)**

Sol. Volume of new cube = $(1^3 + 6^3 + 8^3)$ cm^3 = 729 cm^3.

Edge of new cube = $\sqrt[3]{729}$ cm = 9 cm.

$\therefore$ Surface area of the new cube = (6 × 9 × 9) cm^2 = 486 cm^2.

Ex. 13. ***If each edge of a cube is increased by 50%, find the percentage increase in its surface area.*** **(R.R.B., 2010)**

Sol. Let original length of each edge = a. Then, original surface area = $6a^2$.

New edge = (150% of a) $= \left(\frac{150}{100}a\right) = \frac{3a}{2}.$

New surface area $= 6 \times \left(\frac{3a}{2}\right)^2 = \frac{27}{2}a^2.$

Increase percent in surface area $= \left(\frac{15}{2}a^2 \times \frac{1}{6a^2} \times 100\right)\% = 125\%.$

Ex. 14. *Two cubes have their volumes in the ratio 1 : 27. Find the ratio of their surface areas.* **(A.A.O. Exam, 2010)**

Sol. Let their edges be a and b. Then, $\frac{a^3}{b^3} = \frac{1}{27}$ or $\left(\frac{a}{b}\right)^3 = \left(\frac{1}{3}\right)^3$ or $\frac{a}{b} = \frac{1}{3}$.

$\therefore$ Ratio of their surface areas $= \frac{6a^2}{6b^2} = \frac{a^2}{b^2} = \left(\frac{a}{b}\right)^2 = \frac{1}{9}$, *i.e.*, $1:9$.

Ex. 15. *Find the volume, curved surface area and the total surface area of a cylinder with diameter of base 7 cm and height 40 cm.*

Sol. Volume $= \pi r^2 h = \left(\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 40\right) \text{ cm}^3 = 1540 \text{ cm}^3$.

Curved surface area $= 2\pi rh = \left(2 \times \frac{22}{7} \times \frac{7}{2} \times 40\right) \text{ cm}^2 = 880 \text{ cm}^2$.

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

$= \left[2 \times \frac{22}{7} \times \frac{7}{2} \times (40 + 3.5)\right] \text{ cm}^2 = 957 \text{ cm}^2$.

Ex. 16. *If the capacity of a cylindrical tank is 1848 m³ and the diameter of its base is 14 m, then find the depth of the tank.*

Sol. Let the depth of the tank be h metres. Then,

$\pi \times (7)^2 \times h = 1848 \Leftrightarrow h = \left(1848 \times \frac{7}{22} \times \frac{1}{7 \times 7}\right) = 12$ m.

Ex. 17. *2.2 cubic dm of lead is to be drawn into a cylindrical wire 0.50 cm in diameter. Find the length of the wire in metres.*

Sol. Let the length of the wire be h metres. Then,

$\pi \times \left(\frac{0.50}{2 \times 100}\right)^2 \times h = \frac{2.2}{1000} \Leftrightarrow h = \left(\frac{2.2}{1000} \times \frac{100 \times 100}{0.25 \times 0.25} \times \frac{7}{22}\right) = 112$ m.

Ex.18. *How many iron rods, each of length 7 m and diameter 2 cm can be made out of 0.88 cubic metre of iron?*

Sol. Volume of 1 rod $= \left(\frac{22}{7} \times \frac{1}{100} \times \frac{1}{100} \times 7\right)$ cu. m $= \frac{11}{5000}$ cu. m.

Volume of iron = 0.88 cu. m.

Number of rods $= \left(0.88 \times \frac{5000}{11}\right) = 400$.

Ex. 19. *A well with 14 m inside diameter is dug 10 m deep. Earth taken out of it has been evenly spread all around it to a width of 21 m to form an embankment. Find the height of the embankment.* **(L.I.C.A.AO., 2007)**

Sol. Volume of earth dug out $= \left(\frac{22}{7} \times 7 \times 7 \times 10\right) \text{m}^3 = 1540 \text{ m}^3$.

Area of embankment $= \frac{22}{7} \times [(28)^2 - (7)^2] = \left(\frac{22}{7} \times 35 \times 21\right) \text{m}^2 = 2310 \text{ m}^2$.

$\therefore$ Height of embankment $= \left(\frac{\text{Volume}}{\text{Area}}\right) = \left(\frac{1540}{2310}\right) \text{m} = \frac{2}{3} \text{m}$.

Ex. 20. *The radii of the bases of two cylinders are in the ratio 3 : 5 and their heights are in the ratio 2 : 3. Find the ratio of their curved surface areas.* **(C.P.O., 2007)**

Sol. Let the radii of the cylinders be $3x$, $5x$ and their heights be $2y$, $3y$ respectively.

Then, Ratio of their curved surface areas $= \frac{2\pi \times 3x \times 2y}{2\pi \times 5x \times 3y} = \frac{2}{5} = 2:5$.

Ex. 21. *If 1 cubic cm of cast iron weighs 21 gms, then find the weight of a cast iron pipe of length 1 metre with a bore of 3 cm and in which thickness of the metal is 1 cm.*

Sol. Inner radius $= \left(\frac{3}{2}\right)$ cm $= 1.5$ cm, Outer radius = (1.5 + 1) cm = 2.5 cm.

$\therefore$ Volume of iron = $[\pi \times (2.5)^2 \times 100 - \pi \times (1.5)^2 \times 100]$ cm^3

$= \dfrac{22}{7} \times 100 \times [(2.5)^2 - (1.5)^2]$ cm^3 $= \left(\dfrac{8800}{7}\right)$ cm^3.

$\therefore$ Weight of the pipe $= \left(\dfrac{8800}{7} \times \dfrac{21}{1000}\right)$ kg = 26.4 kg.

Ex. 22. ***Find the slant height, volume, curved surface area and the whole surface area of a cone of radius 21 cm and height 28 cm.***

Sol. Here, r = 21 cm and h = 28 cm.

$\therefore$ Slant height, $l = \sqrt{r^2 + h^2} = \sqrt{(21)^2 + (28)^2} = \sqrt{1225} = 35$ cm.

Volume $= \dfrac{1}{3}\pi r^2 h = \left(\dfrac{1}{3} \times \dfrac{22}{7} \times 21 \times 21 \times 28\right)$ cm^3 = 12936 cm^3.

Curved surface area $= \pi r l = \left(\dfrac{22}{7} \times 21 \times 35\right)$ cm^2 = 2310 cm^2.

Total surface area $= (\pi r l + \pi r^2) = \left(2310 + \dfrac{22}{7} \times 21 \times 21\right)$ cm^2 = 3696 cm^2.

Ex. 23. ***A conical tent is required to accommodate 5 persons and each person needs 16 cm^2 of space on the ground and 100 cubic metres of air to breathe. Find the vertical height of the tent.***

Sol. Let the radius of the base of the tent be r and the vertical height be h.

Then, area of the base = πr^2.

$\therefore \pi r^2 = 16 \times 5 = 80 \Rightarrow r^2 = \dfrac{80}{\pi}$.

Volume of the tent $= \dfrac{1}{3}\pi r^2 h = \dfrac{1}{3} \times \pi \times \dfrac{80}{\pi} \times h = \dfrac{80h}{3}$.

$\therefore \dfrac{80h}{3} = 100 \times 5 \Rightarrow 80h = 1500 \Rightarrow h = \dfrac{75}{4} = 18\dfrac{3}{4}$.

Hence, height of the tent $= 18\dfrac{3}{4}$ m.

Ex. 24. ***How many metres of cloth 5 m wide will be required to make a conical tent, the radius of whose base is 7m and height is 24 m?*** **(M.A.T., 2006)**

Sol. Here, r = 7 m and h = 24 m.

So, $l = \sqrt{r^2 + h^2} = \sqrt{7^2 + (24)^2} = \sqrt{625} = 25$ m.

Area of canvas $= \pi r l = \left(\dfrac{22}{7} \times 7 \times 25\right)$ m^2 = 550 m^2.

$\therefore$ Length of canvas $= \left(\dfrac{\text{Area}}{\text{Width}}\right) = \left(\dfrac{550}{5}\right)$ m = 110 m.

Ex. 25. ***The heights of two right circular cones are in the ratio 1 : 2 and the perimeters of their bases are in the ratio 3 : 4. Find the ratio of their volumes.***

Sol. Let the radii of their bases be r and R and their heights be h and $2h$ respectively.

Then, $\dfrac{2\pi r}{2\pi R} = \dfrac{3}{4} \Rightarrow \dfrac{r}{R} = \dfrac{3}{4} \Rightarrow R = \dfrac{4}{3}r$.

$\therefore$ Ratio of volumes $= \dfrac{\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi\left(\frac{4}{3}r\right)^2 (2h)} = \dfrac{9}{32} = 9 : 32$.

Ex. 26. *If the heights of two cones are in the ratio 7 : 3 and their diameters are in the ratio 6 : 7, what is the ratio of their volumes?* **(M.B.A., 2009)**

Sol. Let the heights of the two cones be $7h$ and $3h$ and their radii be $6r$ and $7r$ respectively. Then,

$$\text{Ratio of their volumes} = \frac{\frac{1}{3} \times \pi \times (6r)^2 \times 7h}{\frac{1}{3} \times \pi \times (7r)^2 \times 3h} = \frac{36 \times 7}{49 \times 3} = \frac{12}{7}.$$

Hence, required ratio = 12 : 7.

Ex. 27. *The radii of the bases of a cylinder and a cone are in the ratio of 3 : 4 and their heights are in the ratio 2 : 3. Find the ratio of their volumes.*

Sol. Let the radii of the cylinder and the cone be $3r$ and $4r$ and their heights be $2h$ and $3h$ respectively.

$$\therefore \quad \frac{\text{Volume of cylinder}}{\text{Volume of cone}} = \frac{\pi \times (3r)^2 \times 2h}{\frac{1}{3}\pi \times (4r)^2 \times 3h} = \frac{9}{8} = 9 : 8.$$

Ex. 28. *A conical vessel, whose internal radius is 12 cm and height 50 cm, is full of liquid. The contents are emptied into a cylindrical vessel with internal radius 10 cm. Find the height to which the liquid rises in the cylindrical vessel.*

Sol. Volume of the liquid in the cylindrical vessel

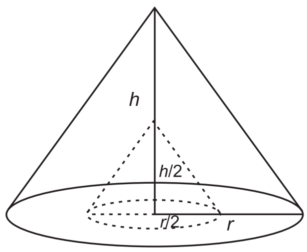
= Volume of the conical vessel

$$= \left(\frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 50\right) \text{cm}^3 = \left(\frac{22 \times 4 \times 12 \times 50}{7}\right) \text{cm}^3.$$

Let the height of the liquid in the vessel be h.

$$\text{Then,} \quad \frac{22}{7} \times 10 \times 10 \times h = \frac{22 \times 4 \times 12 \times 50}{7} \text{ or } h = \left(\frac{4 \times 12 \times 50}{10 \times 10}\right) = 24 \text{ cm}.$$

Ex. 29. *The radius and height of a right solid circular cone are r and h respectively. A conical cavity of radius* $\frac{r}{2}$ *and height* $\frac{h}{2}$ *is cut out of this cone. What is the whole surface area of the rest of the portion?*



Sol. Clearly, required surface area = Total surface area of bigger cone + Curved surface area of smaller cone − Area of base of smaller cone

$$= \left[\left(\pi r\sqrt{r^2 + h^2} + \pi r^2\right) + \pi\left(\frac{r}{2}\right)\sqrt{\left(\frac{r}{2}\right)^2 + \left(\frac{h}{2}\right)^2} - \pi\left(\frac{r}{2}\right)^2\right]$$

$$= \pi r\sqrt{r^2 + h^2} + \pi r^2 + \frac{\pi r}{2}\sqrt{\frac{r^2 + h^2}{4}} - \frac{\pi r^2}{4}$$

$$= \pi r\sqrt{r^2 + h^2} + \pi r^2 + \frac{\pi r}{4}\sqrt{r^2 + h^2} - \frac{\pi r^2}{4}$$

$$= \frac{4\pi r\sqrt{r^2 + h^2} + 4\pi r^2 + \pi r\sqrt{r^2 + h^2} - \pi r^2}{4}$$

$$= \frac{5\pi r\sqrt{r^2 + h^2} + 3\pi r^2}{4} = \frac{\pi r}{4}\left(5\sqrt{r^2 + h^2} + 3r\right).$$

Ex. 30. *In a rocket shaped firecracker, explosive powder is to be filled up inside the metallic enclosure. The metallic enclosure is made up of a cylindrical base and conical top with the base of radius 8 cm. The ratio of height of cylinder and cone is 5 : 3. A cylindrical hole is drilled through the metal solid with height one-third the height of metal solid. What should be the radius of the hole, so that volume of the hole (in which gun powder is to be filled up) is half of the volume of metal after drilling?* **(I.I.F.T., 2010)**

Sol. Let the height of cylinder and cone be $5x$ and $3x$ cm respectively.

Then, height of metal solid = $(5x + 3x)$ cm = $8x$ cm.

Height of hole $= \left(\frac{8x}{3}\right)$ cm.

Radius of cylinder = Radius of cone = 8 cm.

Let the radius of the hole be r cm.

Volume of metal solid after drilling

= Volume of cylinder + Volume of cone – Volume of hole

$$= \left(\pi \times 8^2 \times 5x + \frac{1}{3}\pi \times 8^2 \times 3x - \pi r^2 \times \frac{8x}{3}\right)\text{cm}^3 = \left(320\,\pi x + 64\pi x - \pi r^2 \cdot \frac{8x}{3}\right)\text{cm}^3 = \left(384\,\pi x - \pi r^2 \cdot \frac{8x}{3}\right)\text{cm}^3.$$

$$\therefore\ 384\pi x - \pi r^2 \cdot \frac{8x}{3} = 2\pi r^2 \cdot \frac{8x}{3} \Rightarrow 3\pi r^2 \cdot \frac{8x}{3} = 384\pi x \Rightarrow r^2 = \frac{384}{8} = 48.$$

$$\Rightarrow r = 4\sqrt{3}\text{ cm.}$$

Ex. 31. ***Find the volume and surface area of a sphere of radius 10.5 cm.***

Sol. Volume $= \frac{4}{3}\pi r^3 = \left(\frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}\right)\text{ cm}^3 = 4851\text{ cm}^3.$

Surface area $= 4\pi r^2 = \left(4 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}\right)\text{ cm}^2 = 1386\text{ cm}^2.$

Ex. 32. ***If the radius of a sphere is increased by 50%, find the increase percent in volume and the increase percent in the surface area.***

Sol. Let original radius = R.

Then, new radius $= \frac{150}{100}R = \frac{3R}{2}.$

Original volume $= \frac{4}{3}\pi R^3$, New volume $= \frac{4}{3}\pi\left(\frac{3R}{2}\right)^3 = \frac{9\pi R^3}{2}.$

Increase % in volume $= \left(\frac{19}{6}\pi R^3 \times \frac{3}{4\pi R^3} \times 100\right)\% = 237.5\%.$

Original surface area $= 4\pi R^2$. New surface area $= 4\pi\left(\frac{3R}{2}\right)^2 = 9\pi R^2.$

Increase % in surface area $= \left(\frac{5\pi R^2}{4\pi R^2} \times 100\right)\% = 125\%.$

Ex. 33. ***Find the number of lead balls, each 1 cm in diameter that can be made from a sphere of diameter 12 cm.***

Sol. Volume of larger sphere $= \left(\frac{4}{3}\pi \times 6 \times 6 \times 6\right)\text{ cm}^3 = 288\pi\text{ cm}^3.$

Volume of 1 small lead ball $= \left(\frac{4}{3}\pi \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right)\text{ cm}^3 = \frac{\pi}{6}\text{ cm}^3.$

$\therefore$ Number of lead balls $= \left(288\pi \times \frac{6}{\pi}\right) = 1728.$

Ex. 34. ***Three spheres of radii 3 cm, 4 cm and 5 cm are melted to form a new sphere. Find the radius of the new sphere.*** **(Hotel Management, 2010)**

Sol. Let the radius of the new sphere be r cm.

Then, Volume of new sphere = Sum of volumes of three spheres

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

$$\Rightarrow r^3 = 3^3 + 4^3 + 5^3 = 27 + 64 + 125 = 216 \Rightarrow r = \sqrt[3]{216} = 6.$$

Hence, radius of new sphere = 6 cm.

Ex. 35. ***How many spherical bullets can be made out of a lead cylinder 28 cm high and with base radius 6 cm, each bullet being 1.5 cm in diameter?*** **(R.R.B., 2003)**

Sol. Volume of cylinder $= (\pi \times 6 \times 6 \times 28)\text{ cm}^3$

$= (36 \times 28)\,\pi\text{ cm}^3.$

Volume of each bullet = $\left(\frac{4}{3}\pi \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4}\right)$ cm^3 = $\frac{9\pi}{16}$ cm^3.

Number of bullets = $\frac{\text{Volume of cylinder}}{\text{Volume of each bullet}} = \left[(36 \times 28)\,\pi \times \frac{16}{9\pi}\right] = 1792.$

Ex. 36. *A copper sphere of diameter 18 cm is drawn into a wire of diameter 4 mm. Find the length of the wire.*

Sol. Volume of sphere = $\left(\frac{4}{3}\pi \times 9 \times 9 \times 9\right)$ cm^3 = 972π cm^3.

Volume of wire = $(\pi \times 0.2 \times 0.2 \times h)$ cm^3.

$\therefore\ 972\pi = \pi \times \frac{2}{10} \times \frac{2}{10} \times h \Rightarrow h = (972 \times 5 \times 5)$ cm $= \left(\frac{972 \times 5 \times 5}{100}\right)$ m = 243 m.

Ex. 37. *Two metallic right circular cones having their heights 4.1 cm and 4.3 cm and the radii of their bases 2.1 cm each, have been melted together and recast into a sphere. Find the diameter of the sphere.*

Sol. Volume of sphere = Volume of 2 cones = $\left[\frac{1}{3}\pi \times (2.1)^2 \times 4.1 + \frac{1}{3}\pi \times (2.1)^2 \times 4.3\right]$ cm^3 $= \frac{1}{3}\pi \times (2.1)^2\ (8.4)$ cm^3.

Let the radius of the sphere be R.

$\therefore\ \frac{4}{3}\pi R^3 = \frac{1}{3}\pi\,(2.1)^3 \times 4$ or $R = 2.1$ cm.

Hence, diameter of the sphere = 4.2 cm.

Ex. 38. *A cone and a sphere have equal radii and equal volumes. Find the ratio of the diameter of the sphere to the height of the cone.*

Sol. Let the radius of each be R and height of the cone be H.

Then, $\frac{4}{3}\pi R^3 = \frac{1}{3}\pi R^2 H$ or $\frac{R}{H} = \frac{1}{4}$ or $\frac{2R}{H} = \frac{2}{4} = \frac{1}{2}$. $\therefore$ Required ratio = 1 : 2.

Ex. 39. *Find the volume, curved surface area and the total surface area of a hemisphere of radius 10.5 cm.*

Sol. Volume = $\frac{2}{3}\pi r^3 = \left(\frac{2}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}\right)$ cm^3 = 2425.5 cm^3.

Curved surface area = $2\pi r^2 = \left(2 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}\right)$ cm^2 = 693 cm^2.

Total surface area = $3\pi r^2 = \left(3 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}\right)$ cm^2 = 1039.5 cm^2.

Ex. 40. *A hemispherical bowl of internal radius 9 cm contains a liquid. This liquid is to be filled into cylindrical shaped small bottles of diameter 3 cm and height 4 cm. How many bottles will be needed to empty the bowl?*

Sol. Volume of bowl = $\left(\frac{2}{3}\pi \times 9 \times 9 \times 9\right)$ cm^3 = 486π cm^3.

Volume of 1 bottle = $\left(\pi \times \frac{3}{2} \times \frac{3}{2} \times 4\right)$ cm^3 = 9π cm^3.

Number of bottles = $\left(\frac{486\pi}{9\pi}\right) = 54.$

Ex. 41. *A cone, a hemisphere and a cylinder stand on equal bases and have the same height. Find the ratio of their volumes.*

Sol. Let R be the radius of each.

Height of hemisphere = Its radius = R.

$\therefore$ Height of each = R.

Ratio of volumes = $\frac{1}{3}\pi R^2 \times R : \frac{2}{3}\pi R^3 : \pi R^2 \times R = 1 : 2 : 3.$

Ex. 42. *A cylindrical container of radius 6 cm and height 15 cm is filled with ice-cream. The whole ice-cream has to be distributed to 10 children in equal cones with hemispherical tops. If the height of the conical portion is four times the radius of its base, then find the radius of the ice-cream cone.* **(M.A.T., 2007)**

Sol. Volume of ice-cream in cylindrical container = $(\pi \times 6^2 \times 15)$ cm^3 = (540π) cm^3.

Let the radius of the base of the cone be r cm.

Then, height of the cone = $(4r)$ cm.

Volume of ice-cream in 10 cones with hemispherical tops = $\left[10\left\{\frac{1}{3}\pi r^2 \times 4r + \frac{2}{3}\pi r^3\right\}\right]\text{cm}^3 = (20\pi r^3)\,\text{cm}^3$.

$\therefore\ 20\,\pi r^3 = 540\pi \Rightarrow r^3 = \frac{540\pi}{20\pi} = 27 \Rightarrow r = 3.$

Hence, radius of ice-cream cone = 3 cm

EXERCISE

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer:*

1. A cuboid has .... edges. **(R.R.B., 2006)**
(*a*) 4 (*b*) 8
(*c*) 12 (*d*) 16

2. 1 litre is equal to
(*a*) 1 cu. cm (*b*) 10 cu. cm
(*c*) 100 cu. cm (*d*) 1000 cu. cm

3. A rectangular water tank is 8 m high, 6 m long and 2.5 m wide. How many litres of water can it hold? **(R.R.B., 2008)**
(*a*) 120 litres (*b*) 1200 litres
(*c*) 12000 litres (*d*) 120000 litres

4. The dimensions of a cuboid are 7cm, 11 cm and 13 cm. The total surface area is **(Teachers' Exam, 2011)**
(*a*) 311 cm^2 (*b*) 622 cm^2
(*c*) 1001 cm^2 (*d*) 2002 cm^2

5. A closed aquarium of dimensions 30 cm × 25 cm × 20 cm is made up entirely of glass plates held together with tapes. The total length of tape required to hold the plates together (ignore the overlapping tapes) is **(Hotel Management, 2009)**
(*a*) 75 cm (*b*) 120 cm
(*c*) 150 cm (*d*) 300 cm

6. The dimensions of a room are 15 m, 10 m and 8 m. The volume of a bag is 2.25 m^3. The maximum number of bags that can be a accommodated in the room is
(*a*) 531 (*b*) 533
(*c*) 535 (*d*) 550

7. A rectangular water reservoir contains 42000 litres of water. If the length of reservoir is 6 m and breadth of the reservoir is 3.5 m, then the depth of the reservoir will be **(R.R.B., 2006)**
(*a*) 2 m (*b*) 5 m
(*c*) 6 m (*d*) 8 m

8. A cistern 6 m long and 4 m wide contains water up to a depth of 1 m 25 cm. The total area of the wet surface is
(*a*) 49 m^2 (*b*) 50 m^2
(*c*) 53.5 m^2 (*d*) 55 m^2

9. A boat having a length 3 m and breadth 2 m is floating on a lake. The boat sinks by 1 cm when a man gets on it. The mass of man is
(*a*) 12 kg (*b*) 60 kg
(*c*) 72 kg (*d*) 96 kg

10. A water tank is 30 m long, 20 m wide and 12 m deep. It is made of iron sheet which is 3 m wide. The tank is open at the top. If the cost of the iron sheet is ₹ 10 per metre, then the total cost of the iron sheet required to build the tank is
(*a*) ₹ 6000 (*b*) ₹ 8000
(*c*) ₹ 9000 (*d*) ₹ 10000

11. Given that 1 cu. cm of marble weighs 25 gms, the weight of a marble block 28 cm in width and 5 cm thick is 112 kg. The length of the block is
(*a*) 26.5 cm (*b*) 32 cm
(*c*) 36 cm (*d*) 37.5 cm

12. Half cubic metre of gold sheet is extended by hammering so as to cover an area of 1 hectare. The thickness of the sheet is
(*a*) 0.0005 cm (*b*) 0.005 cm
(*c*) 0.05 cm (*d*) 0.5 cm

13. In a shower, 5 cm of rain falls. The volume of water that falls on 1.5 hectares of ground is :
(*a*) 75 cu. m (*b*) 750 cu. m
(*c*) 7500 cu. m (*d*) 75000 cu. m

14. The breadth of a room is twice its height and half its length. The volume of the room is 512 cu. m. The length of the room is **(N.M.A.T., 2007)**
(*a*) 16 m (*b*) 18 m
(*c*) 20 m (*d*) 32 m

15. The length of a cold storage is double its breadth. Its height is 3 metres. The area of its four walls (including the doors) is 108 m^2. Find its volume.
(*a*) 215 m^3 (*b*) 216 m^3
(*c*) 217 m^3 (*d*) 218 m^3

16. The length of a hall is 20 metres and the width is 16 metres. The sum of the areas of the floor and roof is equal to the sum of the areas of the four walls. Find the volume of the hall.

(*a*) 2844.4 m^3 (*b*) 2866.8 m^3
(*c*) 2877.8 m^3 (*d*) 2899.8 m^3

17. If V be the volume and S be the surface area of a cuboid of dimensions a, b, c, then $\frac{1}{V}$ is equal to

(*a*) $\frac{S}{2}(a+b+c)$ (*b*) $\frac{2}{S}\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$
(*c*) $\frac{2S}{a+b+c}$ (*d*) $2S\ (a+b+c)$

18. The volume of a rectangular block of stone is 10368 dm^3. Its dimensions are in the ratio of 3 : 2 : 1. If its entire surface is polished at 2 paise per dm^2, then the total cost will be

(*a*) ₹ 31.50 (*b*) ₹ 31.68
(*c*) ₹ 63 (*d*) ₹ 63.36

19. The dimensions of a rectangular box are in the ratio 2 : 3 : 4 and the difference between the cost of covering it with sheet of paper at the rate of ₹ 8 and ₹ 9.50 per square metre is ₹ 1248. Find the dimensions of the box in meters.

(*a*) 2 m, 12 m, 8 m (*b*) 4 m, 9 m, 16 m
(*c*) 8 m, 12 m, 16 m (*d*) None of these

20. It is required to construct a big rectangular hall to accommodate 500 persons, allowing 22.5 m^3 space per person. The height of the hall is to be kept at 7.5 m, while the total inner surface area of the walls must be 1200 sq. m. Then the length and breadth of the hall respectively are

(*a*) 40 m and 30 m (*b*) 45 m and 35 m
(*c*) 50 m and 30 m (*d*) 60 m and 20 m

21. 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 length and depth. The length of the tank is **(S.S.C., 2005)**

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

22. The length of the longest rod that can be placed in a room of dimensions 10 m × 10 m × 5 m is **(S.S.C., 2010)**

(*a*) $15\sqrt{3}$ (*b*) 15
(*c*) $10\sqrt{2}$ (*d*) $5\sqrt{3}$

23. Find the length of the longest rod that can be placed in a room 16 m long, 12 m broad and $10\frac{2}{3}$ m high.

(*a*) $22\frac{1}{3}$ m (*b*) $22\frac{2}{3}$ m
(*c*) 23 m (*d*) 68 m

24. The volume of a rectangular solid is 210 cm^3 and the surface area is 214 cm^2. If the area of the base is 42 cm^2, then the edges of the rectangular solid are

(*a*) 3, 4 and 5 cm (*b*) 4, 5 and 6 cm
(*c*) 5, 6 and 7 cm (*d*) 6, 6 and 8 cm

25. How many bricks, each measuring 25 cm × 11.25 cm × 6 cm, will be needed to build a wall 8 m × 6 m × 22.5 cm? **(M.A.T., 2008)**

(*a*) 5600 (*b*) 6000
(*c*) 6400 (*d*) 7200

26. The number of bricks, each measuring 25 cm × 12.5 cm × 7.5 cm, required to construct a wall 6 m long, 5 m high and 0.5 m thick, while the mortar occupies 5% of the volume of the wall, is

(*a*) 3040 (*b*) 5740
(*c*) 6080 (*d*) 8120

27. 50 men took a dip in a water tank 40 m long and 20 m broad on a religious day. If the average displacement of water by a man is 4 m^3, then the rise in the water level in the tank will be :

(*a*) 20 cm (*b*) 25 cm
(*c*) 35 cm (*d*) 50 cm

28. A swimming bath is 24 m long and 15 m broad. When a number of men dive into the bath, the height of the water rises by 1 cm. If the average amount of water displaced by one of the men be 0.1 cu. m, how many men are there in the bath? **(N.M.A.T., 2005)**

(*a*) 32 (*b*) 36
(*c*) 42 (*d*) 46

29. 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 metres long, what must be its breadth and height? **(M.A.T., 2010)**

(*a*) 11 m, 4 m (*b*) 11 m, 5 m
(*c*) 12 m, 5.5 m (*d*) 13 m, 6 m

30. A rectangular tank measuring 5 m × 4.5 m × 2.1 m is dug in the centre of the field measuring 13.5 m by 2.5 m. The earth dug out is evenly spread over the remaining portion of the field. How much is the level of the field raised? **(M.A.T. 2005)**

(*a*) 4 m (*b*) 4.1 m
(*c*) 4.2 m (*d*) 4.3 m

31. A plot of land in the form of a rectangle has dimensions 240 m × 180 m. A drainlet 10 m wide is dug all around it (outside) and the earth dug out is evenly spread over the plot, increasing its surface level by 25 cm. The depth of the drainlet is **(M.A.T., 2006)**

(*a*) 1.223 m (*b*) 1.225 m
(*c*) 1.227 m (*d*) 1.229 m

32. A cistern, open at the top, is to be lined with sheet of lead which weights 27 kg/m^2. The cistern is 4.5 m long and 3 m wide and holds 50 m^3. The weight of lead required is **(M.A.T., 2009)**

(*a*) 1660.5 kg (*b*) 1764.5 kg
(*c*) 1860.5 kg (*d*) 1864.5 kg

33. If a river 2.5 m deep and 45 m wide is flowing at the rate of 3.6 km per hour, then the amount of water that runs into the sea per minute is

(*a*) 6650 cu. m (*b*) 6750 cu. m
(*c*) 6850 cu. m (*d*) 6950 cu. m

34. A rectangular water tank is 80 m × 40 m. Water flows into it through a pipe 40 sq. cm at the opening at a speed of 10 km / hr. By how much, the water level will rise in the tank in half an hour?

(*a*) $\frac{3}{2}$ cm (*b*) $\frac{4}{9}$ cm
(*c*) $\frac{5}{8}$ cm (*d*) None of these

35. A rectangular tank is 225 m by 162 m at the base. With what speed must water flow into it through an aperture 60 cm by 45 cm so that the level may be raised 20 cm in 5 hours? **(M.A.T., 2006)**

(*a*) 5000 m/hr (*b*) 5200 m/hr
(*c*) 5400 m/hr (*d*) 5600 m/hr

36. The water in a rectangular reservoir having a base 80 m by 60 m is 6.5 m deep. In what time can the water be emptied by a pipe of which the cross-section is a square of side 20 cm, if the water runs through the pipe at the rate of 15 km per hour?

(*a*) 26 hrs (*b*) 42 hrs
(*c*) 52 hrs (*d*) 65 hrs

37. Rita and Meeta both are having lunch boxes of a cuboidal shape. Length and breadth of Rita's lunch box are 10% more than that of Meeta's lunch box, but the depth of Rita's lunch box is 20% less than that of Meeta's lunch box. The ratio of the capacity of Rita's lunch box to that of Meeta's lunch box is **(Hotel Management, 2010)**

(*a*) 11 : 15 (*b*) 15 : 11
(*c*) 121 : 125 (*d*) 125 : 121

38. The sum of the length, breadth and depth of a cuboid is 19 cm and its diagonal is $5\sqrt{5}$ cm. It surface area is

(*a*) 125 cm^2 (*b*) 236 cm^2
(*c*) 361 cm^2 (*d*) 486 cm^2

39. The sum of perimeters of the six faces of a cuboid is 72 cm and the total surface area of the cuboid is 16 cm^2. Find the longest possible length that can be kept inside the cuboid

(*a*) 5.2 cm (*b*) 7.8 cm
(*c*) 8.05 cm (*d*) 8.36 cm

40. A swimming pool 9 m wide and 12 m long is 1 m deep on the shallow side and 4 m deep on the deeper side. Its volume is :

(*a*) 208 m^3 (*b*) 270 m^3
(*c*) 360 m^3 (*d*) 408 m^3

41. Length of a rectangular solid is increased by 10% and breadth is decreased by 10%. Then the volume of the solid

(*a*) remains unchanged (*b*) decreases by 1%
(*c*) decreases by 10% (*d*) increases by 10%

42. The length, breadth and height of a cuboid are in the ratio 1 : 2 : 3. The length, breadth and height of the cuboid are increased by 100%, 200% and 200% respectively. Then the increase in the volume of the cuboid is

(*a*) 5 times (*b*) 6 times
(*c*) 12 times (*d*) 17 times

43. A rectangular piece of cardboard 18 cm × 24 cm is made into an open box by cutting a square of 5 cm side from each corner and building up the side. Find the volume of the box in cu. cm.

(*a*) 216 (*b*) 432
(*c*) 560 (*d*) None of these

44. An open box is made by cutting the congruent squares from the corners of a rectangular sheet of cardboard of dimensions 20 cm × 15 cm. If the side of each square is 2 cm, the total outer surface area of the box is **(Hotel Management, 2010)**

(*a*) 148 cm^2 (*b*) 284 cm^2
(*c*) 316 cm^2 (*d*) 460 cm^2

45. A closed box made of wood of uniform thickness has length, breadth and height 12 cm, 10 cm and 8 cm respectively. If the thickness of the wood is 1 cm, the inner surface area is **(E.S.T.C., 2006)**

(*a*) 264 cm^2 (*b*) 376 cm^2
(*c*) 456 cm^2 (*d*) 696 cm^2

46. A covered wooden box has the inner measures as 115 cm, 75 cm and 35 cm and the thickness of wood is 2.5 cm. Find the volume of the wood. **(M.B.A.,2008)**

(*a*) 81000 cu.cm (*b*) 81775 cu.cm
(*c*) 82125 cu.cm (*d*) None of these

47. The dimensions of an open box are 52 cm × 40 cm × 29 cm. Its thickness is 2 cm. If 1 cu. cm of metal used in the box weighs 0.5 gm, then the weight of the box is **(M.B.A., 2011)**

(*a*) 6.832 kg (*b*) 7.576 kg
(*c*) 7.76 kg (*d*) 8.56 kg

48. An open box is made of wood 3 cm thick. Its external dimensions are 1.46 m, 1.16 m and 8.3 dm. The cost of painting the inner surface of the box at 50 paise per 100 sq. cm is

(*a*) ₹ 138.50 (*b*) ₹ 277
(*c*) ₹ 415. 50 (*d*) ₹ 554

49. A cistern of capacity 8000 litres measures externally 3.3 m by 2.6 m by 1.1 m and its walls are 5 cm thick. The thickness of the bottom is

(*a*) 90 cm (*b*) 1 dm
(*c*) 1 m (*d*) 1.1 m

50. If a metallic cuboid weighs 16 kg, how much would a miniature cuboid of metal weigh, if all dimensions are reduced to one-fourth of the original?
(*a*) 0.25 kg (*b*) 0.50 kg
(*c*) 0.75 kg (*d*) 1 kg

51. A rectangular water tank is open at the top. Its capacity is 24 m^3. Its length and breadth are 4 m and 3 m respectively. Ignoring the thickness of the material used for building the tank, the total cost of painting the inner and outer surfaces of the tank at the rate of ₹ 10 per m^2 is **(M.B.A., 2006)**
(*a*) ₹ 400 (*b*) ₹ 500
(*c*) ₹ 600 (*d*) ₹ 800

52. If the areas of three adjacent faces of a cuboid are x, y, z respectively, then the volume of the cuboid is **(M.B.A. 2005, 2007)**
(*a*) xyz (*b*) $2xyz$
(*c*) $\sqrt{xyz}$ (*d*) $3\sqrt{xyz}$

53. 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 the box.
(*a*) 720 cm^3 (*b*) 864 cm^3
(*c*) 7200 cm^3 (*d*) $(72)^2$ cm^3

54. If the areas of three adjacent faces of a rectangular block are in the ratio of 2 : 3 : 4 and its volume is 9000 cu. cm; then the length of the shortest side is
(*a*) 10 cm (*b*) 15 cm
(*c*) 20 cm (*d*) 30 cm

55. The dimensions of a certain machine are 48″ × 30″ × 52″. If the size of the machine is increased proportionately until the sum of its dimensions equals 156″, what will be the increase in the shortest side? **(Campus Recruitment, 2009)**
(*a*) 4″ (*b*) 6″
(*c*) 8″ (*d*) 9″

56. If a metal slab of size 1 m × 20 cm × 1 cm is melted to another slab of 1 mm thickness and 1 m width, then the length of the new slab thus formed will be
(*a*) 200 cm (*b*) 400 cm
(*c*) 600 cm (*d*) 1000 cm

57. Rahul hired a contractor to dig a well of 10 metres length, 10 metres breadth and 10 metres depth for ₹ 40000. However, when the contractor was about to start the work, he changed his mind and asked him to get two wells dug, each with a length of 5 metres, breadth of 5 metres and depth of 5 metres. How much should Rahul pay to the contractor?
(*a*) ₹ 10000 (*b*) ₹ 20000
(*c*) ₹ 40000 (*d*) None of these

58. Each side of a cube measures 8 metres. What is the volume of the cube? **(P.C.S., 2008)**
(*a*) 72 cu. m (*b*) 144 cu. m
(*c*) 196 cu. m (*d*) None of these

59. The perimeter of one face of a cube is 20 cm. Its volume must be
(*a*) 125 cm^3 (*b*) 400 cm^3
(*c*) 1000 cm^3 (*d*) 8000 cm^3

60. Total surface area of a cube whose side is 0.5 cm is
(*a*) $\frac{1}{4}$ cm^2 (*b*) $\frac{1}{8}$ cm^2
(*c*) $\frac{3}{4}$ cm^2 (*d*) $\frac{3}{2}$ cm^2

61. The cost of the paint is ₹ 36.50 per kg. If 1 kg of paint covers 16 square feet, how much will it cost to paint outside of a cube having 8 feet each side?
(*a*) ₹ 692 (*b*) ₹ 768
(*c*) ₹ 876 (*d*) ₹ 972
(*e*) None of these

62. If the volume of a cube is 729 cm^3, then the surface area of the cube will be
(*a*) 456 cm^2 (*b*) 466 cm^2
(*c*) 476 cm^2 (*d*) 486 cm^2

63. The surface area of a cube is 150 cm^2. Its volume is **(E.S.I.C., 2006)**
(*a*) 64 cm^3 (*b*) 125 cm^3
(*c*) 150 cm^3 (*d*) 216 cm^3

64. The dimensions of a piece of iron in the shape of a cuboid are 270 cm × 100 cm × 64 cm. If it is melted and recast into a cube, then the surface area of the cube will be
(*a*) 14400 cm^2 (*b*) 44200 cm^2
(*c*) 57600 cm^2 (*d*) 86400 cm^2

65. The cost of painting the whole surface area of a cube at the rate of 13 paise per sq. cm is ₹ 343.98. Then the volume of the cube is :
(*a*) 8500 cm^3 (*b*) 9000 cm^3
(*c*) 9250 cm^3 (*d*) 9261 cm^3

66. An aluminium sheet 27 cm long, 8 cm broad and 1 cm thick is melted into a cube. The difference in the surface areas of the two solids would be **(M.B.A., 2008)**
(*a*) Nil (*b*) 284 cm^2
(*c*) 286 cm^2 (*d*) 296 cm^2

67. The length of an edge of a hollow cube open at one face is $\sqrt{3}$ metres. What is the length of the largest pole that it can accommodate?
(*a*) $\sqrt{3}$ m (*b*) 3 m
(*c*) $3\sqrt{3}$ m (*d*) $\frac{3}{\sqrt{3}}$ m

68. What is the volume of a cube (in cubic cm) whose diagonal measures $4\sqrt{3}$ cm?
(*a*) 8 (*b*) 16
(*c*) 27 (*d*) 64

69. If the total length of diagonals of a cube is 12 cm, then what is the total length of the edges of the cube? **(C.D.S., 2005)**

(*a*) $6\sqrt{3}$ cm (*b*) 12 cm
(*c*) 15 cm (*d*) $12\sqrt{3}$ cm

70. If the surface area of a cube is 13254 cm^2, then the length of its diagonal is

(*a*) $44\sqrt{3}$ cm (*b*) $45\sqrt{3}$ cm
(*c*) $46\sqrt{3}$ cm (*d*) $47\sqrt{3}$ cm

71. V_1, V_2, V_3 and V_4 are the volumes of four cubes of side lengths x cm, $2x$ cm, $3x$ cm and $4x$ cm respectively. Some statements regarding these volumes are given below

(1) $V_1 + V_2 + 2V_3 < V_4$
(2) $V_1 + 4V_2 + V_3 < V_4$
(3) $2(V_1 + V_3) + V_2 = V_4$

Which of these statements are correct?

(*a*) 1 and 2 (*b*) 2 and 3
(*c*) 1 and 3 (*d*) 1, 2 and 3

72. From a cube of side 8m, a square hole of 3m side is hollowed from end to end. What is the volume of the remaining solid? **(R.R.B., 2006)**

(*a*) 440 m^3 (*b*) 480 m^3
(*c*) 508 m^3 (*d*) 520 m^3

73. If the numbers representing volume and surface area of a cube are equal, then the length of the edge of the cube in terms of the unit of measurement will be

(*a*) 3 (*b*) 4
(*c*) 5 (*d*) 6

74. The volume of a cube is numerically equal to the sum of its edges. What is its total surface area in square units?

(*a*) 36 (*b*) 66
(*c*) 72 (*d*) 183

75. Except for one face of a given cube, identical cubes are glued through their faces to all the other faces of the given cube. If each side of the given cube measures 3 cm, then what is the total surface area of the solid body thus formed?

(*a*) 225 cm^2 (*b*) 234 cm^2
(*c*) 270 cm^2 (*d*) 279 cm^2

76. A solid cube just gets completely immersed in water when a 0.2 kg mass is placed on it. If the mass is removed, the cube is 2 cm above the water level. What is the length of each side of the cube? **(P.C.S., 2009)**

(*a*) 6 cm (*b*) 8 cm
(*c*) 10 cm (*d*) 12 cm

77. A cube of length 1 cm is taken out from a cube of length 8 cm. What is the weight of the remaining portion? **(C.P.F., 2007)**

(*a*) $\frac{7}{8}$ of the weight of the original cube

(*b*) $\frac{8}{9}$ of the weight of the original cube

(*c*) $\frac{63}{64}$ of the weight of the original cube

(*d*) $\frac{511}{512}$ of the weight of the original cube

78. How many cubes of 10 cm edge can be put in a cubical box of 1 m edge? **(M.B.A., 2008)**

(*a*) 10 (*b*) 100
(*c*) 1000 (*d*) 10000

79. A 4 cm cube is cut into 1 cm cubes. The total surface area of all the small cubes is **(M.B.A., 2005)**

(*a*) 24 cm^2 (*b*) 96 cm^2
(*c*) 384 cm^2 (*d*) None of these

80. A rectangular block with a volume of 250 cm^3 was sliced into two cubes of equal volume. How much greater (in sq. cm) is the combined surface area of the two cubes then the original surface area of the rectangular block?

(*a*) 48.64 (*b*) 50
(*c*) 56.25 (*d*) 84.67

81. A rectangular box measures internally 1.6 m long, 1 m broad and 60 cm deep. The number of cubical blocks each of edge 20 cm that can be packed inside the box is

(*a*) 30 (*b*) 53
(*c*) 60 (*d*) 120

82. How many cubes of 3 cm edge can be cut out of a cube of 18 cm edge?

(*a*) 36 (*b*) 216
(*c*) 218 (*d*) 432

83. Shobhraj takes a cube of 1 m edge-length and meticulously cuts smaller cubes, each of edge-length 1 mm from the parent cube. He joins these small cubes end-to-end. Thus, the total length of this 'cube-robe' will be

(*a*) 1 km (*b*) 10 km
(*c*) 100 km (*d*) 1000 km

84. How many small cubes, each of 96 cm surface area, can be formed from the material obtained by melting a larger cube of 384 cm surface area? **(M.A.T., 2007)**

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

85. The volume of a cuboid is twice that 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 **(S.S.C., 2005)**

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

86. A cuboidal block of 6 cm × 9 cm × 12 cm is cut up into an exact number of equal cubes. The least possible number of cubes will be

(*a*) 6 (*b*) 9
(*c*) 24 (*d*) 30

87. The size of a wooden block is $5 \times 10 \times 20$ cm. How many such blocks will be required to construct a solid wooden cube of minimum size?
(*a*) 6 (*b*) 8
(*c*) 12 (*d*) 16

88. An iron cube of side 10 cm is hammered into a rectangular sheet of thickness 0.5 cm. If the sides of the sheet are in the ratio 1 : 5, the sides are
(a) 10 cm, 50 cm (b) 20 cm, 100 cm
(c) 40 cm, 200 cm (d) None of these

89. A cube of white chalk is painted red, and then cut parallel to the sides to form two rectangular solids of equal volumes. What percent of the surface area of each of the new solids is not painted red?
(*a*) 15% (*b*) $16\frac{2}{3}\%$
(*c*) 20% (*d*) 25%

90. There is a cube of volume 216 cm^3. It is to be moulded into a cuboid having one edge equal to 6 cm. The number of ways that it can be done so that the edges have different integral values is
(*a*) 1 (*b*) 2
(*c*) 3 (*d*) 4

91. If three cubes of copper, each with an edge of 6 cm 8 cm and 10 cm respectively are melted to form a single cube, then the diagonal of the new cube will be
(*a*) 18 cm (*b*) 19 cm
(*c*) 19.5 cm (*d*) 20.8 cm

92. A larger cube is formed from the material obtained by melting three smaller cubes of 3, 4 and 5 cm side. The ratio of the total surface areas of the smaller cubes and the larger cube is **(I.I.F.T., 2005)**
(*a*) 2 : 1 (*b*) 3 : 2
(*c*) 25 : 18 (*d*) 27 : 20

93. Five equal cubes, each of side 5 cm, are placed adjacent to each other. The volume of the new solid formed will be
(*a*) 125 cm^3 (*b*) 625 cm^3
(*c*) 15525 cm^3 (*d*) None of these

94. If three equal cubes are placed adjacently in a row, then the ratio of the total surface area of the new cuboid to the sum of the surface areas of the three cubes will be **(M.A.T., 2007)**
(*a*) 1 : 3 (*b*) 2 : 3
(*c*) 5 : 9 (*d*) 7 : 9

95. Three cubes with sides in the ratio 3 : 4 : 5 are melted to form a single cube whose diagonal is $12\sqrt{3}$ cm. The sides of the cubes are
(*a*) 3 cm, 4 cm, 5 cm (*b*) 6 cm, 8 cm, 10 cm
(*c*) 9 cm, 12 cm, 15 cm (*d*) None of these

96. If the volumes of two cubes are in the ratio 27 : 1, the ratio of their edges is
(*a*) 1 : 3 (*b*) 1 : 27
(*c*) 3 : 1 (*d*) 27 : 1

97. The volumes of two cubes are in the ratio 8 : 27. The ratio of their surface areas is
(*a*) 2 : 3 (*b*) 4 : 9
(*c*) 12 : 9 (*d*) None of these

98. Two cubes have volumes in the ratio 1 : 27. Then the ratio of the area of the face of one of the cubes to that of the other is
(*a*) 1 : 3 (*b*) 1 : 6
(*c*) 1 : 9 (*d*) 1 : 12

99. If each edge of a cube is doubled, then its volume:
(*a*) is doubled (*b*) becomes 4 times
(*c*) becomes 6 times (*d*) becomes 8 times

100. By what percent the volume of a cube increases if the length of each edge was increased by 50%? **(Bank P.O., 2011)**
(*a*) 50% (*b*) 125%
(*c*) 237.5% (*d*) 273.5%

101. If each edge of a cube is increased by 25%, then the percentage increase in its surface area is :
(*a*) 25% (*b*) 48.75%
(*c*) 50% (*d*) 56.25%

102. A cube of edge 20 cm is completely immersed in a rectangular vessel containing water. If the dimensions of the base of the vessel are 20 cm by 40 cm, the rise in water level will be
(*a*) 2 cm (*b*) 8 cm
(*c*) 10 cm (*d*) 14 cm

103. A circular well with a diameter of 2 metres, is dug to a depth of 14 metres. What is the volume of the earth dug out? **(S.S.C., 1999)**
(*a*) 32 m^3 (*b*) 36 m^3
(*c*) 40 m^3 (*d*) 44 m^3

104. Find the cost of a cylinder of radius 14 m and height 3.5 m when the cost of its metal is ₹ 50 per cubic metre. **(B.Ed Entrance, 2008)**
(*a*) ₹ 100208 (*b*) ₹ 107800
(*c*) ₹ 10800 (*d*) ₹ 109800

105. If the radius and height of a right circular cylinder are 21 cm and 35 cm respectively, then the total surface area of the cylinder is
(*a*) 7092 sq cm (*b*) 7192 sq cm
(*c*) 7292 sq cm (*d*) 7392 sq cm

106. The capacity of a cylindrical tank is 246.4 litres. If the height is 4 metres, what is the diameter of the base?
(*a*) 1.4 m (*b*) 2.8 m
(*c*) 14 m (*d*) 28 m
(*e*) None of these

107. The volume of a right circular cylinder, 14 cm in height is equal to that of a cube whose edge is 11 cm. The radius of the base of the cylinder is **(C.P.O., 2006)**

(*a*) 5.2 cm (*b*) 5.5 cm
(*c*) 11 cm (*d*) 22 cm

108. Capacity of a cylindrical vessel is 25.872 litres. If the height of the cylinder is three times the radius of its base, what is the area of the base? **(Bank P.O. 2007)**

(*a*) 336 cm^2 (*b*) 616 cm^2
(*c*) 1232 cm^2 (*d*) Cannot be determined
(*e*) None of these

109. Two rectangular sheets of paper, each 30 cm × 18 cm are made into two right circular cylinders, one by rolling the paper along its length and the other along the breadth. The ratio of the volumes of the two cylinders, thus formed, is **(M.B.A., 2006)**

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

110. Three rectangles A_1, A_2 and A_3 have the same area. Their lengths a_1, a_2 and a_3 respectively are such that $a_1 < a_2 < a_3$. Cylinders C_1, C_2 and C_3 are formed from A_1, A_2 and A_3 respectively by joining the parallel sides along the breadth. Then

(*a*) C_1 will enclosed maximum volume
(*b*) C_2 will enclosed maximum volume
(*c*) C_3 will enclosed maximum volume
(*d*) Each of C_1, C_2 and C_3 will enclose equal volume

111. The volume of a right circular cylinder whose curved surface area is 2640 cm^2 and circumference of its base is 66 cm, is

(*a*) 3465 cm^3 (*b*) 7720 cm^3
(*c*) 13860 cm^3 (*d*) 55440 cm^3

112. A well has to be dug out that is to be 22.5 m deep and of diameter 7m. Find the cost of plastering the inner curved surface at ₹ 3 per sq. meter. **(M.A.T., 2006; M.B.A., 2007)**

(*a*) ₹ 1465 (*b*) ₹ 1475
(*c*) ₹ 1485 (*d*) ₹ 1495

113. The radius and height of a cylinder are in the ratio 5 : 7 and its volume is 4400 cm^3. Then its radius will be

(*a*) 4 cm (*b*) 5 cm
(*c*) 10 cm (*d*) 12 cm

114. The height of a right circular cylinder is 14 cm and its curved surface is 704 sq. cm. Then its volume is:

(*a*) 1408 cm^3 (*b*) 2816 cm^3
(*c*) 5632 cm^3 (*d*) 9856 cm^3

115. A closed metallic cylindrical box is 1.25 m high and its base radius is 35 cm. If the sheet metal costs ₹ 80 per m^2, the cost of the material used in the box is

(*a*) ₹ 281.60 (*b*) ₹ 290
(*c*) ₹ 340.50 (*d*) ₹ 500

116. The curved surface area of a right circular cylinder of base radius r is obtained by multiplying its volume by

(*a*) $2r$ (*b*) $\frac{2}{r}$
(*c*) $2r^2$ (*d*) $\frac{2}{r^2}$

117. The ratio of total surface area to lateral surface area of a cylinder whose radius is 20 cm and height 60 cm, is

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

118. Two cans have the same height equal to 21 cm. 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 their capacities? **(M.A.T., 2010)**

(*a*) 250 cm^3 (*b*) 300 cm^3
(*c*) 350 cm^3 (*d*) 450 cm^3

119. The diameter of the base of a cylindrical drum is 35 dm and the height is 24 dm. It is full of kerosene. How many tins each of size 25 cm × 22 cm × 35 cm can be filled with kerosene from the drum?

(*a*) 120 (*b*) 600
(*c*) 1020 (*d*) 1200

120. The radius of the cylinder is half its height and area of the inner part is 616 sq. cms. Approximately how many litres of milk can it contain?

(*a*) 1.4 (*b*) 1.53
(*c*) 1.7 (*d*) 1.9
(*e*) 2.2

121. The sum of the radius of the base and the height of a solid cylinder is 37 metres. If the total surface area of the cylinder be 1628 sq. metres, its volume is

(*a*) 3180 m^3 (*b*) 4620 m^3
(*c*) 5240 m^3 (*d*) None of these

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

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

123. The height of a right circular cylinder is 6 m. If three times the sum of the areas of its two circular faces is twice the area of the curved surface, then the radius of its base is

(*a*) 1 m (*b*) 2 m
(*c*) 3 m (*d*) 4 m

124. The height of a closed cylinder of given volume and the minimum surface area is

(*a*) equal to its diameter (*b*) half of its diameter
(*c*) double of its diameter (*d*) None of these

125. If the radius of the base of a right circular cylinder is halved, keeping the height same, what is the ratio of the volume of the reduced cylinder to that of the original one? **(Hotel Management, 2005)**
(*a*) 1 : 2 (*b*) 1 : 4
(*c*) 1 : 8 (*d*) 8 : 1

126. The radii of the bases of two cylinders are in the ratio 3 : 4 and their heights are in the ratio 4 : 3. The ratio of their volumes is **(S.S.C., 2005)**
(*a*) 2 : 3 (*b*) 3 : 2
(*c*) 3 : 4 (*d*) 4 : 3

127. If the height of a cylinder is increased by 15 percent and the radius of its base is decreased by 10 percent then by what percent will its curved surface area change? **(S.S.C., 2006)**
(*a*) 3.5 percent decrease (*b*) 3.5 percent increase
(*c*) 5 percent decrease (*d*) 5 percent increase

128. If two cylinders of equal volumes have their heights in the ratio 2 : 3, then the ratio of their radii is **(Bank P.O., 2010)**
(*a*) $\sqrt{6} : \sqrt{3}$ (*b*) $\sqrt{5} : \sqrt{3}$
(*c*) 2 : 3 (*d*) $\sqrt{3} : \sqrt{2}$

129. *X* and *Y* are two cylinders of the same height. The base of *X* has diameter that is half the diameter of the base of *Y*. If the height of *X* is doubled, the volume of *X* becomes
(*a*) equal to the volume of *Y*
(*b*) double the volume of *Y*
(*c*) half the volume of *Y*
(*d*) greater than the volume of *Y*

130. The radius of a wire is decreased to one-third and its volume remains the same. The new length is how many times the original length?
(*a*) 1 time (*b*) 3 times
(*c*) 6 times (*d*) 9 times

131. If the radius of a cylinder is decreased by 50% and the height is increased by 50% to form a new cylinder, the volume will be decreased by
(*a*) 0% (*b*) 25%
(*c*) 62.5% (*d*) 75%

132. Diameter of a jar cylindrical in shape is increased by 25%. By what percent must the height be decreased so that there is no change in its volume?
(*a*) 10 (*b*) 25
(*c*) 36 (*d*) 50
(A.A.O. Exam, 2009)

133. A cylindrical tank of diameter 35 cm is full of water. If 11 litres of water is drawn off, the water level in the tank will drop by
(*a*) $10\frac{1}{2}$ cm (*b*) $11\frac{3}{7}$ cm
(*c*) $12\frac{6}{7}$ cm (*d*) 14 cm

134. A well with inner diameter 8 m is dug 14 m deep. Earth taken out of its has been evenly spread all around it to a width of 3 m to form an embankment. The height of the embankment will be **(G.B.O., 2007)**
(*a*) $4\frac{26}{33}$ m (*b*) $5\frac{26}{33}$ cm
(*c*) $6\frac{26}{33}$ cm (*d*) $7\frac{26}{33}$ cm

135. Water flows through a cylindrical pipe of internal diameter 7 cm at 2 m per second. If the pipe is always half full, then what is the volume of water (in litres) discharged in 10 minutes?
(*a*) 2310 (*b*) 3850
(*c*) 4620 (*d*) 9240

136. The radius of a cylindrical cistern is 10 metres and its height is 15 metres. Initially the cistern is empty. We start filling the cistern with water through a pipe whose diameter is 50 cm. Water is coming out of the pipe with a velocity of 5 m/sec. How many minutes will it take in filling the cistern with water? **(M.A.T., 2007)**
(*a*) 20 (*b*) 40
(*c*) 60 (*d*) 80

137. It is required to fix a pipe such that water flowing through it at a speed of 7 metres per minute fills a tank of capacity 440 cubic metres in 10 minutes. The inner radius of the pipe should be **(M.A.T., 2005)**
(*a*) $\sqrt{2}$ m (*b*) 2 m
(*c*) $\frac{1}{2}$ m (*d*) $\frac{1}{\sqrt{2}}$ m

138. Water flows out through a circular pipe whose internal diameter is 2 cm, at the rate of 6 metres per second into a cylindrical tank, the radius of whose base is 60 cm. By how much will the level of water rise in 30 minutes? **(M.A.T., 2006)**
(*a*) 2 m (*b*) 3 m
(*c*) 4 m (*d*) 5 m

139. Water is poured into an empty cylindrical tank at a constant rate for 5 minutes. After the water has been poured into the tank, the depth of the water is 7 feet. The radius of the tank is 100 feet. Which of the following is the best approximation for the rate at which the water was poured into the tank? **(M.B.A., 2006)**
(*a*) 140 cubic feet/sec (*b*) 440 cubic feet/sec
(*c*) 700 cubic feet/sec (*d*) 2200 cubic feet/sec

140. The number of circular pipes with an inside diameter of 1 inch which will carry the same amount of water as a pipe with an inside diameter of 6 inches is **(M.B.A., 2011)**
(*a*) 6π (*b*) 12
(*c*) 36 (*d*) 36π

141. Find the number of coins 1.5 cm in diameter and 0.2 cm thick, to be melted to form a right circular cylinder of height 10 cm and diameter 4.5 cm. **(M.A.T., 2005)**

(*a*) 430 (*b*) 440
(*c*) 450 (*d*) 460

142. Two cylindrical vessels with radii 15 cm and 10 cm and heights 35 cm and 15 cm respectively are filled with water. If this water is poured into a cylindrical vessel 15 cm in height, then the radius of the vessel is

(*a*) 17.5 cm (*b*) 18 cm
(*c*) 20 cm (*d*) 25 cm

143. 66 cubic centimetres of silver is drawn into a wire 1 mm in diameter. The length of the wire in metres will be

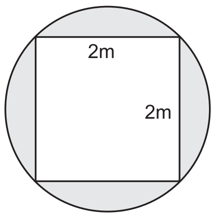
(*a*) 84 (*b*) 90
(*c*) 168 (*d*) 336

144. A copper rod of 1 cm diameter and 8 cm length is drawn into a wire of uniform diameter and 18 m length. The radius (in cm) of the wire is, **(S.S.C., 2005)**

(*a*) $\frac{1}{15}$ (*b*) $\frac{1}{30}$
(*c*) $\frac{2}{15}$ (*d*) 15

145. The diameter of a garden roller is 1.4 m and it is 2 m long. How much area will it cover in 5 revolutions?

(*a*) 36 m^2 (*b*) 40 m^2
(*c*) 44 m^2 (*d*) 48 m^2



146. A square pond has 2 m sides and is 1 m deep. If it is to be enlarged, the depth remaining the same, into a circular pond with the diagonal of the square as diameter as shown in the figure, then what would be the volume of earth to be removed?

(*a*) $(2\pi - 2)$ m^3 (*b*) $(2\pi - 4)$ m^3
(*c*) $(4\pi - 2)$ m^3 (*d*) $(4\pi - 4)$ m^3

147. What part of a ditch, 48 metres long, 16.5 metres broad and 4 metres deep can be filled by the earth got by digging a cylindrical tunnel of diameter 4 metres and length 56 metres? **(S.S.C., 2007)**

(*a*) $\frac{1}{9}$ (*b*) $\frac{2}{9}$
(*c*) $\frac{7}{9}$ (*d*) $\frac{8}{9}$

148. Water is flowing at the rate of 5 km/hr through a cylindrical pipe of diameter 14 cm into a rectangular tank which is 50 m long and 44 m wide. Determine the time in which the level of water in the tank will rise by 7 cm. **(S.S.C., 2008)**

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

149. The trunk of a tree is a right cylinder 1.5 m in radius and 10 m high. The volume of the timber which remains when the trunk is trimmed just enough to reduce it to a rectangular parallelopiped on a square base is **(M.A.T. 2006)**

(*a*) 44 m^3 (*b*) 45 m^3
(*c*) 46 m^3 (*d*) 47 m^3

150. Rain water, which falls on a flat rectangular surface of length 6 m and breadth 4 m is transferred into a cylindrical vessel of internal radius 20 cm. What will be the height of water in the cylindrical vessel if a rainfall of 1 cm has fallen?

(*a*) 188 cm (*b*) 189 cm
(*c*) 190 cm (*d*) 191 cm

151. An iron pipe 20 cm long has exterior diameter equal to 25 cm. If the thickness of the pipe is 1 cm, then the whole surface of the pipe is **(M.A.T. 2007)**

(*a*) 3068 cm^2 (*b*) 3168 cm^2
(*c*) 3268 cm^2 (*d*) 3368 cm^2

152. A hollow garden roller 63 cm wide with a girth of 440 cm is made of iron 4 cm thick. The volume of the iron used is

(*a*) 54982 cm^3 (*b*) 56372 cm^3
(*c*) 57636 cm^3 (*d*) 58752 cm^3

153. 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

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

154. What length of solid cylinder 2 cm in diameter must be taken to cast into a hollow cylinder of external diameter 12 cm, 0.25 cm thick and 15 cm long?

(*a*) 42.3215 cm (*b*) 44.0123 cm
(*c*) 44.0625 cm (*d*) 44.6023 cm

155. A hollow iron pipe is 21 cm long and its external diameter is 8 cm. If the thickness of the pipe is 1 cm and iron weighs 8 g/cm^3, then the weight of the pipe is

(*a*) 3.6 kg (*b*) 3.696 kg
(*c*) 36 kg (*d*) 36.9 kg

156. 1496 cm^3 of metal is used to cast a pipe of length 28 cm. If the internal radius of the pipe is 8 cm, the outer radius of the pipe is **(M.A.T., 2007)**

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

157. A milkman saves milk in two vessels, a cuboidal and the other a cylindrical one. The capacity of the cuboidal vessel is 20 litres more than the cylinddrical one. When 30 litres of milk is drawn from each of the two full vessels, the amount left in the cuboidal vessel is twice that left in the cylindrical vessel. The capacity (in litres) of the cuboidal vessel is **(I.I.F.T., 2005)**

(*a*) 30 (*b*) 50
(*c*) 70 (*d*) 130
(*e*) None of these

158. A circular cylinder can hold 61.6 c.c. of water. If the height of the cylinder is 40 cm and the outer diameter is 16 mm, then the thickness of the material of the cylinder is
(*a*) 0.2 mm (*b*) 0.3 mm
(*c*) 1 mm (*d*) 2 mm

159. Which one of the following figures will generate a cone when rotated about one of its straight edges?
(*a*) An equilateral triangle
(*b*) A sector of a circle
(*c*) A segment of a circle
(*d*) A right-angled triangle

160. The radius of the base and height of a cone are 3 cm and 5 cm respectively whereas the radius of the base and height of a cylinder are 2 cm and 4 cm respectively. The ratio of the volume of cone to that of the cylinder is
(*a*) 1 : 3 (*b*) 15 : 8
(*c*) 15 : 16 (*d*) 45 : 16

161. What is the weight of water contained in a conical vessel 21 cm deep and 16 cm in diameter? **(R.R.B., 2006)**
(*a*) 1.256 kg (*b*) 1.408 kg
(*c*) 2.480 kg (*d*) 3.875 kg

162. Find the slant height of the cone whose height is 4.8 cm and the diameter of base is 4 cm.
(*a*) 4.2 cm (*b*) 5.2 cm
(*c*) 6.2 cm (*d*) 7.2 cm

163. The curved surface of a right circular cone of height 84 cm and base diameter 70 cm is
(*a*) 1001 cm^2 (*b*) 9900 cm^2
(*c*) 10001 cm^2 (*d*) 10010 cm^2

164. The curved surface of a right circular cone of height 15 cm and base diameter 16 cm is
(*a*) 60π cm^2 (*b*) 68π cm^2
(*c*) 120π cm^2 (*d*) 136π cm^2

165. What is the total surface area of a right circular cone of height 14 cm and base radius 7 cm?
(*a*) 344.35 cm^2 (*b*) 462 cm^2
c) 498.35 cm^2 (*d*) None of these

166. A right triangle with sides 3 cm, 4 cm and 5 cm is rotated about the side of 3 cm to form a cone. The volume of the cone so formed is
(*a*) 12π cm^3 (*b*) 15π cm^3
(*c*) 16π cm^3 (*d*) 20π cm^3

167. The slant height of a right circular cone is 10 m and its height is 8 m. Find the area of its curved surface.
(*a*) 30π m^2 (*b*) 40π m^2
(*c*) 60π m^2 (*d*) 80π m^2

168. If a right circular cone of height 24 cm has a volume of 1232 cm^3, then the area of its curved surface is
(*a*) 154 cm^2 (*b*) 550 cm^2
(*c*) 704 cm^2 (*d*) 1254 cm^2

169. A conical tent is to accommodate 11 persons. Each person must have 4 sq. metres of the space on the ground and 20 cubic metres of air to breathe. The height of the cone is **(M.A.T., 2006)**
(*a*) 13 m (*b*) 14 m
(*c*) 15 m (*d*) 16 m

170. Area of the canvas cloth needed to erect a right conical tent of height 12 ft and circular base having circumference 10π ft is
(*a*) 60 sq ft (*b*) 65 sq ft
(*c*) 65π sq ft (*d*) 120π sq ft

171. The slant height of a conical mountain is 2.5 km and the area of its base is 1.54 km^2. The height of the mountain is
(*a*) 2.2 km (*b*) 2.4 km
(*c*) 3 km (*d*) 3.11 km

172. If the area of the base of a right circular cone is 3850 cm^2 and its height is 84 cm, then the curved surface area of the cone is
(*a*) 10001 cm^2 (*b*) 10010 cm^2
(*c*) 10100 cm^2 (*d*) 11000 cm^2

173. Volume of a right circular cone having base radius 70 cm and curved surface area 40040 cm^2 is
(*a*) 823400 cm^3 (*b*) 824000 cm^3
(*c*) 840000 cm^3 (*d*) 862400 cm^3

174. The radius and height of a right circular cone are in the ratio 3 : 4. If its volume is $301\frac{5}{7}\,cm^3$, what is its slant height?
(*a*) 8 cm (*b*) 9 cm
(*c*) 10 cm (*d*) 12 cm

175. A vertical cone of volume *V* with vertex downwards is filled with water upto half of its height. The volume of the water is
(*a*) $\frac{V}{2}$ (*b*) $\frac{V}{4}$
(*c*) $\frac{V}{8}$ (*d*) $\frac{V}{16}$

176. A semicircular sheet of paper of diameter 28 cm is bent to cover the exterior surface of an open conical ice-cream cup. The depth of the ice-cream cup is **(M.A.T., 2006)**
(*a*) 8.12 cm (*b*) 10.12 cm
(*c*) 12.12 cm (*d*) 14.12 cm

177. The length of canvas 1.1 m wide required to build a conical tent of height 14 m and the floor area 346.5 sq. m is
(*a*) 490 m (*b*) 525 m
(*c*) 665 m (*d*) 860 m

178. If the height of a cone is doubled and its base diameter is trebled, then the ratio of the volume of the resultant cone to that of the original cone is
(*a*) 6 : 1 (*b*) 9 : 1
(*c*) 9 : 2 (*d*) 18 : 1

179. If both the radius and height of a right circular cone are increased by 20%, its volume will be increased by
(*a*) 20% (*b*) 40%
(*c*) 60% (*d*) 72.8%

180. If the height of a right circular cone is increased by 200% and the radius of the base is reduced by 50%, then the volume of the cone
(*a*) remains unaltered (*b*) decreases by 25%
(*c*) increases by 25% (*d*) increases by 50%

181. If the height of a cone be doubled and radius of base remains the same, then the ratio of the volume of the given cone to that of the second cone will be
(*a*) 1 : 2 (*b*) 2 : 1
(*c*) 1 : 8 (*d*) 8 : 1

182. If the height, curved surface area and the volume of a cone are h, c and v respectively, then $3\pi vh^3 - c^2h^2 + 9v^2$ will be equal to
(*a*) 0 (*b*) 1
(*c*) chv (*d*) v^2h

183. If the heights of two cones are in the ratio 7 : 3 and their diameters are in the ratio 6 : 7, what is the ratio of their volumes? **(M.B.A., 2009)**
(*a*) 3 : 7 (*b*) 4 : 7
(*c*) 5 : 7 (*d*) 12 : 7

184. The radii of two cones are in the ratio 2 : 1, their volumes are equal. Find the ratio of their heights.
(*a*) 1 : 8 (*b*) 1 : 4
(*c*) 2 : 1 (*d*) 4 : 1

185. If the ratio of volumes of two cones is 2 : 3 and the ratio of the radii of their bases is 1 : 2, then the ratio of their heights will be
(*a*) 3 : 4 (*b*) 4 : 3
(*c*) 3 : 8 (*d*) 8 : 3

186. Find the volume of the largest right circular cone that can be cut out from a cube whose edge is 9 cm.
(*a*) 170.93 cm^3 (*b*) 180.93 cm^3
(*c*) 190.93 cm^3 (*d*) 200.93 cm^3

187. 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 of wood wasted is
(*a*) 34% (*b*) 46%
(*c*) 54% (*d*) 66%

188. A right circular cone and a right circular cylinder have equal base and equal height. If the radius of the base and the height are in the ratio 5 : 12, then the ratio of the total surface area of the cylinder to that of the cone is
(*a*) 3 : 1 (*b*) 13 : 9
(*c*) 17 : 9 (*d*) 34 : 9

189. A conical cavity is drilled in a circular cylinder of 15 cm height and 16 cm base diameter. The height and base diameter of the cone are the same as those of the cylinder. Determine the total surface area of the remaining solid.
(*a*) 215 π cm^2 (*b*) 376 π cm^2
(*c*) 440 π cm^2 (*d*) 542 π cm^2

190. The radius of the base and height of a metallic solid cylinder are r cm and 6 cm respectively. It is melted and recast into a solid cone of the same radius of base. The height of the cone is **(C.P.O., 2007)**
(*a*) 9 cm (*b*) 18 cm
(*c*) 27 cm (*d*) 54 cm

191. A solid metallic right circular cylinder of base diameter 16 cm and height 2 cm is melted and recast into a right circular cone of height three times that of the cylinder. Find the curved surface area of the cone. [Use π = 3.14] **(S.S.C., 2007)**
(*a*) 196.8 cm^2 (*b*) 228.4 cm^2
(*c*) 251.2 cm^2 (*d*) None of these

192. A right cylindrical vessel is full of water. How many right cones having the same radius and height as those of the right cylinder will be needed to store that water?
(*a*) 2 (*b*) 3
(*c*) 4 (*d*) 8

193. A solid metallic cylinder of base radius 3 cm and height 5 cm is melted to form cones, each of height 1 cm and base radius 1 mm. The number of cones is
(*a*) 450 (*b*) 1350
(*c*) 4500 (*d*) 13500

194. Ice cream completely filled in a cylinder of diameter 35 cm and height 32 cm is to be served by completely filling identical disposable cones of diameter 4 cm and height 7 cm. The maximum number of persons that can be served this way is
(*a*) 950 (*b*) 1000
(*c*) 1050 (*d*) 1100

195. A solid cylinder and a solid cone have equal base and equal height. If the radius and height be in the ratio of 4 : 3, the ratio of the total surface area of the cylinder to that of the cone is
(*a*) 10 : 9 (*b*) 11 : 9
(*c*) 12 : 9 (*d*) 14 : 9

196. Water flows at the rate of 10 metres per minute from a cylindrical pipe 5 mm in diameter. How long will it take to fill up a conical vessel whose diameter at the base is 40 cm and depth 24 cm?
(*a*) 48 min. 15 sec. (*b*) 51 min. 12 sec.
(*c*) 52 min. 1 sec. (*d*) 55 min.

197. A conical flask has base radius a cm and height h cm. it is completely filled with milk. The milk is poured into a cylindrical thermos flask whose base radius is p cm. What will be the height of the milk level in the flask?

(*a*) $\frac{a^2h}{3p^2}$ cm (*b*) $\frac{3hp^2}{a^2}$ cm

(*c*) $\frac{p^2}{3h^2}$ cm (*d*) $\frac{3a^2}{hp^2}$ cm

198. A solid cylindrical block of radius 12 cm and height 18 cm is mounted with a conical block of radius 12 cm and height 5 cm. The total lateral surface of the solid thus formed is

(*a*) 528 cm^2 (*b*) $1357\frac{5}{7}$ cm^2

(*c*) 1848 cm^2 (*d*) None of these

199. A tent is in the form of a right circular cylinder surmounted by a cone. The diameter of the cylinder is 24 m. The height of the cylindrical portion is 11 m while the vertex of the cone is 16 m above the ground. The area of the canvas required for the tent is **(M.A.T., 2006)**

(*a*) 1300 m^2 (*b*) 1310 m^2

(*c*) 1320 m^2 (*d*) 1330 m^2

200. A fountain having the shape of a right circular cone is fitted into a cylindrical tank of volume V so that the base of the tank coincides with the base of the cone and the height of the tank is the same as that of the cone. The volume of water in the tank, when it is completely filled with water from the fountain, is

(*a*) $\frac{V}{2}$ (*b*) $\frac{V}{3}$

(*c*) $\frac{V}{4}$ (*d*) $\frac{2V}{3}$

201. In a right circular cone, the radius of its base is 7 cm and its height is 24 cm. A cross-section is made through the mid-point of the height parallel to the base. The volume of the upper portion is **(S.S.C., 2006)**

(*a*) 154 cm^3 (*b*) 169 cm^3

(*c*) 800 cm^3 (*d*) 1078 cm^3

202. A right circular cone is divided into two portions by a plane parallel to the base and passing through a point which is $\frac{1}{3}$rd of the height from the top. The ratio of the volume of the smaller cone to that of the remaining frustum of the cone is

(*a*) 1 : 3 (*b*) 1 : 9

(*c*) 1 : 26 (*d*) 1 : 27

203. A bucket is in the form of a frustum of a cone and holds 28.490 litres of water. The radii of the top and bottom are 28 cm and 21 cm respectively. Find the height of the bucket.

(*a*) 15 cm (*b*) 20 cm

(*c*) 25 cm (*d*) 30 cm

204. A cone of height 10 cm and radius 5 cm is cut into two parts at half its height. The cut is given parallel to its circular base. What is the ratio of the curved surface area of the original cone and the curved surface area of the frustum?

(*a*) 3 : 1 (*b*) 3 : 2

(*c*) 4 : 1 (*d*) 4 : 3

205. A sphere, cylinder and cone of dimensions radius = r cm and height = $2r$ cm are made. Which one has the greatest volume?

(*a*) Cone (*b*) Sphere

(*c*) Cylinder (*d*) All have equal volume

206. Consider the volumes of the following **(Civil Services, 2002)**

1. A parallelopiped of length 5 cm, breadth 3 cm and height 4 cm
2. A cube of each side 4 cm
3. A cylinder of radius 3 cm and length 3 cm
4. A sphere of radius 3 cm

The volumes of these in the decreasing order is :

(*a*) 1, 2, 3, 4 (*b*) 1, 3, 2, 4

(*c*) 4, 2, 3, 1 (*d*) 4, 3, 2, 1

207. The volume of a sphere is $2145\frac{11}{21}$ cm^3. Its radius is equal to **(R.R.B., 2008)**

(*a*) 7 cm (*b*) 8 cm

(*c*) 9 cm (*d*) None of these

208. The volume of a sphere is 4851 cu. cm. Its curved surface area is

(*a*) 1386 cm^2 (*b*) 1625 cm^2

(*c*) 1716 cm^2 (*d*) 3087 cm^2

209. The curved surface area of a sphere is 5544 sq. cm. Its volume is

(*a*) 22176 cm^3 (*b*) 33951 cm^3

(*c*) 38808 cm^3 (*d*) 42304 cm^3

210. The volume of a sphere of radius r is obtained by multiplying its surface area by

(*a*) $\frac{4}{3}$ (*b*) $\frac{r}{3}$

(*c*) $\frac{4r}{3}$ (*d*) $3r$

211. For a sphere of radius 10 cm, what percent of the numerical value of its volume would be the numerical value of the surface area?

(*a*) 24% (*b*) 26.5%

(*c*) 30% (*d*) 45%

212. If the volume of a sphere is divided by its surface area, the result is 27 cm. The radius of the sphere is

(*a*) 9 cm (*b*) 36 cm

(*c*) 54 cm (*d*) 81 cm

213. If the radii of two spheres are in the ratio 1 : 4, then their surface areas are in the ratio **(C.P.O., 2007)**

(*a*) 1 : 2 (*b*) 1 : 4
(*c*) 1 : 8 (*d*) 1 : 16

214. The radii of two spheres are in the ratio 3 : 2. Their volumes will be in the ratio **(C.P.O., 2007)**

(*a*) 9 : 4 (*b*) 8 : 27
(*c*) 27 : 8 (*d*) 3 : 2

215. Surface area of a sphere is 2464 cm^2. If its radius be doubled, then the surface area of the new sphere will be :

(*a*) 4928 cm^2 (*b*) 9856 cm^2
(*c*) 19712 cm^2 (*d*) Data insufficient

216. If the radius of a sphere is doubled, how many times does its volume become? **(R.R.B., 2006, 2008)**

(*a*) 2 times (*b*) 4 times
(*c*) 6 times (*d*) 8 times

217. If the radius of a sphere is increased by 2 cm, then its surface area increases by 352 cm^2. The radius of the sphere before the increase was

(*a*) 3 cm (*b*) 4 cm
(*c*) 5 cm (*d*) 6 cm

218. If the measured value of the radius is 1.5% larger, the percentage error (correct to one decimal place) made in calculating the volume of a sphere is

(*a*) 2.1 (*b*) 3.2
(*c*) 4.6 (*d*) 5.4

219. The volumes of two spheres are in the ratio of 64 : 27. The ratio of their surface areas is **(Bank P.O., 2010)**

(*a*) 1 : 2 (*b*) 2 : 3
(*c*) 9 : 16 (*d*) 16 : 9

220. If the surface areas of two spheres are in the ratio of 4 : 25, then the ratio of their volumes is **(M.B.A., 2009)**

(*a*) 4 : 25 (*b*) 25 : 4
(*c*) 125 : 8 (*d*) 8 : 125

221. If the volume and surface area of a sphere are numerically the same, then its radius is **(C.P.O., 2006)**

(*a*) 1 unit (*b*) 2 units
(*c*) 3 units (*d*) 4 units

222. If three metallic spheres of radii 6 cms, 8 cms and 10 cms are melted to form a single sphere, the diameter of the new sphere will be **(Bank P.O., 2009)**

(*a*) 12 cms (*b*) 24 cms
(*c*) 30 cms (*d*) 36 cms

223. A solid metallic sphere of radius 8 cm is melted and recast into spherical balls each of radius 2 cm. The number of spherical balls, thus obtained, is

(*a*) 16 (*b*) 48
(*c*) 64 (*d*) 82

224. A spherical ball of lead, 3 cm in diameter is melted and recast into three spherical balls. The diameter of two of these are 1.5 cm and 2 cm respectively. The diameter of the third ball is **(M.A.T., 2005; 2009)**

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

225. If a solid sphere of radius 10 cm is moulded into 8 spherical solid balls of equal radius, then the surface area of each ball is

(*a*) 50π cm^2 (*b*) 60π cm^2
(*c*) 75π cm^2 (*d*) 100π cm^2

226. A hollow spherical metallic ball has an external diameter 6 cm and is $\frac{1}{2}$ cm thick. The volume of metal used in the ball is

(*a*) $37\frac{2}{3}$ cm^3 (*b*) $40\frac{2}{3}$ cm^3
(*c*) $41\frac{2}{3}$ cm^3 (*d*) $47\frac{2}{3}$ cm^3

227. A solid piece of iron of dimensions 49 × 33 × 24 cm is moulded into a sphere. The radius of the sphere is

(*a*) 21 cm (*b*) 28 cm
(*c*) 35 cm (*d*) None of these

228. How many bullets can be made out of a cube of lead whose edge measures 22 cm, each bullet being 2 cm in diameter?

(*a*) 1347 (*b*) 2541
(*c*) 2662 (*d*) 5324

229. The volume of the largest sphere which can be carved out of a cube of side 6 cm is

(*a*) 113.14 cm^3 (*b*) 166 cm^3
(*c*) 179.66 cm^3 (*d*) 188.52 cm^3

230. How many lead shots each 3 mm in diameter can be made from a cuboid of dimensions 9 cm × 11 cm × 12 cm? **(A.A.O. Exam, 2009)**

(*a*) 7200 (*b*) 8400
(*c*) 72000 (*d*) 84000

231. A sphere and a cube have equal surface areas. The ratio of the volume of the sphere to that of the cube is **(S.S.C., 2005; M.A.T., 2006)**

(*a*) $\sqrt{\pi} : \sqrt{6}$ (*b*) $\sqrt{2} : \sqrt{\pi}$
(*c*) $\sqrt{\pi} : \sqrt{3}$ (*d*) $\sqrt{6} : \sqrt{\pi}$

232. The ratio of the volume of a cube to that of a sphere which will fit inside the cube is **(M.A.T., 2010)**

(*a*) 4 : π (*b*) 4 : 3π
(*c*) 6 : π (*d*) 2 : π

233. The volume of the largest possible cube that can be inscribed in a hollow spherical ball of radius *r* cm is **(Hotel Management, 2009)**

(a) $\frac{2}{\sqrt{3}}r^2$ (b) $\frac{4}{3}r^2$

(c) $\frac{8}{3\sqrt{3}}r^3$ (d) $\frac{1}{3\sqrt{3}}r^3$

234. A right circular cylinder and a sphere are of equal volumes and their radii are also equal. If h is the height of the cylinder and d, the diameter of the sphere, then **(S.S.C., 2007)**

(a) $h = d$ (b) $2h = d$

(c) $\frac{h}{3} = \frac{d}{2}$ (d) $\frac{h}{2} = \frac{d}{3}$

235. The surface area of a sphere is same as the curved surface area of a right circular cylinder whose height and diameter are 12 cm each. The radius of the sphere is

(a) 3 cm (b) 4 cm

(c) 6 cm (d) 12 cm

236. The diameter of the iron ball used for the shot-put game is 14 cm. It is melted and then a solid cylinder of height $2\frac{1}{3}$ cm is made. What will be the diameter of the base of the cylinder?

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

(c) 28 cm (d) $\frac{28}{3}$ cm

237. A solid metallic sphere of radius r is converted into a solid right circular cylinder of radius R. If the height of the cylinder is twice the radius of the sphere, then **(A.A.O. Exam, 2010)**

(a) $R = r$ (b) $R = r\sqrt{\frac{2}{3}}$

(c) $R = \sqrt{\frac{2r}{3}}$ (d) $R = \frac{2r}{3}$

238. The ratio of the volumes of a right circular cylinder and a sphere is 3 : 2. If the radius of the sphere is double the radius of the base of the cylinder, find the ratio of the total surface areas of the cylinder and the sphere. **(S.S.C., 2006)**

(a) 9 : 8 (b) 13 : 8

(c) 15 : 8 (d) 17 : 8

239. The volume of the greatest sphere that can be cut off from a cylindrical log of wood of base radius 1 cm and height 5 cm is

(a) $\frac{4}{3}\pi$ (b) $\frac{10}{3}\pi$

(c) 5π (d) $\frac{20}{3}\pi$

240. How many spherical bullets can be made out of a lead cylinder 15 cm high and with base radius 3 cm, each bullet being 5 mm in diameter?

(a) 6000 (b) 6480

(c) 7260 (d) 7800

241. A cylindrical rod of iron whose height is eight times its radius is melted and cast into spherical balls each of half the radius of the cylinder. The number of spherical balls is

(a) 12 (b) 16

(c) 24 (d) 48

242. A copper wire of length 36 m and diameter 2 mm is melted to form a sphere. The radius of the sphere (in cm) is **(M.B.A., 2008; S.S.C., 2010)**

(a) 2.5 (b) 3

(c) 3.5 (d) 4

243. The diameter of a sphere is 8 cm. It is melted and drawn into a wire of diameter 3 mm. The length of the wire is **(M.B.A., 2009)**

(a) 36.9 m (b) 37.9 m

(c) 38.9 m (d) 39.9 m

244. A cylindrical vessel of radius 4 cm contains water. A solid sphere of radius 3 cm is lowered into the water until it is completely immersed. The water level in the vessel will rise by :

(a) $\frac{2}{9}$ cm (b) $\frac{4}{9}$ cm

(c) $\frac{9}{4}$ cm (d) $\frac{9}{2}$ cm

245. The ratio of the surface area of a sphere and the curved surface area of the cylinder circumscribing the sphere is **(C.P.O., 2006)**

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

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

246. 12 spheres of the same size are made from melting a solid cylinder of 16 cm diameter and 2 cm height. The diameter of each sphere is

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

(c) 3 cm (d) 4 cm

247. A spherical iron ball is dropped into a cylindrical vessel of base diameter 14 cm containing water. The water level is increased by $9\frac{1}{3}$ cm. What is radius of the ball?

(a) 3.5 cm (b) 7 cm

(c) 9 cm (d) 12 cm

248. If a hollow sphere of internal and external diameters 4 cm and 8 cm respectively is melted into a cylinder of base diameter 8 cm, then the height of the cylinder is

(a) 4 cm (b) $\frac{13}{3}$ cm

(c) $\frac{14}{3}$ cm (d) 5 cm

249. Each of the measures of the radius of the base of a cone and that of a sphere is 8 cm. Also, the volumes of these two solids are equal. The slant height of the cone is

(a) 34 cm (b) $34\sqrt{2}$ cm

(c) $4\sqrt{17}$ cm (d) $8\sqrt{17}$ cm

250. A metallic sphere of radius 5 cm is melted to make a cone with base of the same radius. What is the height of the cone? **(R.R.B., 2006)**

(a) 5 cm (b) 10 cm

(c) 15 cm (d) 20 cm

251. Some solid metallic right circular cones, each with radius of the base 3 cm and height 4 cm, are melted to form a solid sphere of radius 6 cm. The number of right circular cones is **(C.P.O., 2007)**

(a) 6 (b) 12

(c) 24 (d) 48

252. A metallic sphere of radius 10.5 cm is melted and recast into small right circular cones, each of base radius 3.5 cm and height 3 cm. The number of cones so formed is **(S.S.C., 2008)**

(a) 105 (b) 113

(c) 126 (d) 135

253. A cone of height 15 cm and base diameter 30 cm is carved out of a wooden sphere of radius 15 cm. The percentage of wood wasted is **(B.Ed Entrance, 2011)**

(a) 25% (b) 40%

(c) 50% (d) 75%

254. A metallic cone of radius 12 cm and height 24 cm is melted and made into spheres of radius 2 cm each. How many spheres are there?

(a) 108 (b) 120

(c) 144 (d) 180

255. In what ratio are the volumes of a cylinder, a cone and a sphere, if each has the same diameter and the same height?

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

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

256. If the diameter of a sphere is 6 m, its hemisphere will have a volume of **(R.R.B., 2007)**

(a) 18π (b) 36π

(c) 72π (d) None of these

257. The total surface area of a solid hemisphere of diameter 14 cm, is

(a) 308 cm^2 (b) 462 cm^2

(c) 1232 cm^2 (d) 1848 cm^2

258. Volume of a hemisphere is 19404 cu. cm. Its radius is

(a) 10.5 cm (b) 17.5 cm

(c) 21 cm (d) 42 cm

259. A hemispherical bowl is 176 cm round the brim. Supposing it to be half full, how many persons may be served from it in hemispherical glasses 4 cm in diameter at the top? **(M.A.T., 2009)**

(a) 1172 (b) 1272

(c) 1372 (d) 1472

260. The capacities of two hemispherical vessels are 6.4 litres and 21.6 litres. The areas of inner curved surfaces of the vessels will be in the ratio of

(a) $\sqrt{2} : \sqrt{3}$ (b) 2 : 3

(c) 4 : 9 (d) 16 : 81

261. A hemispherical bowl is made of steel 0.5 cm thick. The inside radius of the bowl is 4 cm. The volume of steel used in making the bowl is

(a) 55.83 cm^3 (b) 56.83 cm^3

(c) 57.83 cm^3 (d) 58.83 cm^3

262. The external and internal diameters of a hemispherical bowl are 10 cm and 8 cm respectively. What is the total surface area of the bowl?

(a) 257.7 cm^2 (b) 286 cm^2

(c) 292 cm^2 (d) 302 cm^2

263. A hemispherical bowl of internal radius 12 cm contains liquid. This liquid is to be filled into cylindrical container of diameter 4 cm and height 3 cm. The number of containers that is necessary to empty the bowl is **(Bank P.O., 2009)**

(a) 80 (b) 96

(c) 100 (d) 112

264. A hemispherical bowl is filled to the brim with a beverage. The contents of the bowl are transferred into a cylindrical vessel whose radius is 50% more than its height. If the diameter is same for both the bowl and the cylinder, the volume of the beverage in the cylindrical vessel is

(a) $66\frac{2}{3}\%$ (b) $78\frac{1}{2}\%$ (c) 100%

(d) More than 100% (*i.e.*, some liquid will be left in the bowl)

265. A water tank open at the top is hemispherical at the bottom and cylindrical above it. If radius of the hemisphere is 12 m and the total capacity of the tank is 3312π m^3, then the ratio of the surface areas of the hemispherical and the cylindrical portions is

(*a*) 1 : 1 (*b*) 3 : 5
(*c*) 4 : 5 (*d*) 6 : 5

266. If a cylindrical tower *D* metres in diameter and *H* metres high is capped with a semi-spherical dome, then the total visible surface of the tower will be

(*a*) $\frac{\pi D}{2}(2H + D)$ (*b*) $\frac{\pi D}{3}(H + 2D)$
(*c*) $\frac{\pi D}{2}\left(2H + \frac{D}{2}\right)$ (*d*) $\frac{\pi D}{3}\left(2H + \frac{D}{2}\right)$

267. The ratio of the volumes of a hemisphere and a cylinder circumscribing this hemisphere and having a common base is **(R.R.B., 2006)**

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

268. A metallic hemisphere is melted and recast in the shape of a cone with the same base radius (*R*) as that of the hemisphere. If H is the height of the cone, then

(*a*) $H = 2R$ (*b*) $H = 3R$
(*c*) $H = \sqrt{3}R$ (*d*) $H = \frac{2}{3}R$

269. A hemisphere of lead of radius 6 cm is cast into a right circular cone of height 75 cm. The radius of the base of the cone is

(*a*) 1.4 cm (*b*) 2 cm
(*c*) 2.4 cm (*d*) 4.2 cm

270. 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 : 2 (*b*) 2 : 1
(*c*) $1 : \sqrt{2}$ (*d*) $\sqrt{2} : 1$

271. If the radius of the base and height of a cylinder and cone are each equal to *r*, and the radius of a hemisphere is also equal to *r*, then the volumes of the cone, cylinder and hemisphere are in the ratio **(N.M.A.T., 2006)**

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

272. A solid body is made up of a cylinder of radius *r* and height *r*, a cone of base radius *r* and height *r* fixed to the cylinder's one base and a hemisphere of radius *r* to its other base. The total volume of the body (given *r* = 2) is

(*a*) 8π (*b*) 16π
(*c*) 32π (*d*) 64π

273. A solid cylinder of base radius 7 cm and height 24 cm is surmounted by a cone of the same radius and same vertical height. A hemisphere surmounts the cylinder at the other end. Surface area of the solid will be

(*a*) 527π cm^2 (*b*) 609π cm^2
(*c*) 707π cm^2 (*d*) 805π cm^2

274. A solid is in the form of a right circular cylinder with hemispherical ends. The total length of the solid is 35 cm. The diameter of the cylinder is $\frac{1}{4}$ of its height. The surface area of the solid is **(A.A.O. Exam, 2010)**

(*a*) 462 cm^2 (*b*) 693 cm^2
(*c*) 750 cm^2 (*d*) 770 cm^2

275. A sphere of maximum volume is cut out from a solid hemisphere of radius *r*. The ratio of the volume of the hemisphere to that of the cut out sphere is :

(*a*) 3 : 2 (*b*) 4 : 1
(*c*) 4 : 3 (*d*) 7 : 4

276. What is the volume in cubic cm of a pyramid whose area of the base is 25 sq cm and height 9 cm? **(R.R.B., 2006)**

(*a*) 60 (*b*) 75
(*c*) 90 (*d*) 105

277. If a regular square pyramid has a base of side 8 cm and height 30 cm, its volume is

(*a*) 120 cc (*b*) 240 cc
(*c*) 640 cc (*d*) 900 cc

278. The base of a pyramid is an equilateral triangle of side 1 m. If the height of the pyramid is 4 metres, then the volume is

(*a*) 0.550 m^3 (*b*) 0.577 m^3
(*c*) 0.678 m^3 (*d*) 0.750 m^3

279. A right pyramid is on a regular hexagonal base. Each side of the base is 10 m and the height is 60 m. The volume of the pyramid is

(*a*) 5000 m^3 (*b*) 5100 m^3
(*c*) 5195 m^3 (*d*) 5196 m^3

280. A pyramid has an equilateral triangle as its base of which each side is 1m. Its slant edge is 3 m. The whole surface area of the pyramid is equal to

(*a*) $\frac{\sqrt{3} + 2\sqrt{13}}{4}$ sq. m (*b*) $\frac{\sqrt{3} + 3\sqrt{13}}{4}$ sq. m

(c) $\frac{\sqrt{3}+3\sqrt{35}}{4}$ sq. m (d) $\frac{\sqrt{3}+2\sqrt{35}}{4}$ sq. m

281. A right pyramid has an equilateral triangular base of side 4 units. If the number of square units of its whole surface area is three times the number of cubic units of its volume, find its height.

(a) 3 units (b) 4 units
(c) 5 units (d) 6 units

282. Length of each edge, of a regular tetrahedron is 1 cm. Its volume is **[SSC—CHSL (10+2) Exam, 2015]**

(a) $\frac{\sqrt{3}}{12}$ cm^3 (b) $\frac{1}{4}\sqrt{3}$ cm^3
(c) $\frac{\sqrt{2}}{6}$ cm^3 (d) $\frac{1}{12}\sqrt{2}$ cm^3

283. The volume of a right circular cone which is obtained from a wooden cube of edge 4.2 dm wasting minimum amount of wood is

[SSC—CHSL (10+2) Exam, 2015]

(a) 19404 dm^3 (b) 194.04 dm^3
(c) 19.404 dm^3 (d) 1940.4 dm^3

284. Base of a right prism is a rectangle, the ratio of whose length and breadth is 3 : 2. If the height of the prism is 12 cm and total surface area is 288 sq. cm. the volume of the prism is

[SSC—CHSL (10+2) Exam, 2015]

(a) 291cm^3 (b) 288cm^3
(c) 290cm^3 (d) 286cm^3

285. The radius of a cylinder is 5m more than its height. If the curved surface area of the cylinder is 792m^2, what is the volume of the cylinder? (in m^3)

[IBPS—Bank Spl. Officers (IT) Exam, 2015]

(a) 5712 (b) 5244
(c) 5544 (d) 5306
(e) 5462

286. The radius of base and curved surface area of a right cylinder is 'r' units and $4\pi rh$ square units respectively. The height of the cylinder is

[SSC—CHSL (10+2) Exam, 2015]

(a) $\frac{h}{2}$ units (b) h units
(c) $2h$ units (d) $4h$ units

287. A hemispherical bowls has 3.5cm radius. It is to be painted inside as well as outside. The cost of painting it at the rate of ₹ 5 per 10sq. cm will be

[SSC—CHSL (10+2) Exam, 2015]

(a) ₹ 77 (b) ₹ 100
(c) ₹ 175 (d) ₹ 50

288. If the volume and curved surfaces area of a cylinder are 616 m^3 and 352m^2 respectively, what is the total surface area of the cylinder (in m^2)

[IBPS—Bank PO/MT (Pre.) Exam, 2015]

(a) 429 (b) 419
(c) 435 (d) 421
(e) 417

289. The radius of a hemispherical bowls is 6cm. The capacity of the bowl is $\left(\text{Take } \pi=\frac{22}{7}\right)$

[SSC—CHSL (10+2) Exam, 2015]

(a) 495.51cm^3 (b) 452.57cm^3
(c) 345.53cm^3 (d) 422cm^3

290. Each side of a cube is decreased by 25%. Find the ratio of the volumes of the original cube and the resulting cube. **[SSC—CHSL (10+2) Exam, 2015]**

(a) 64 : 1 (b) 27 : 64
(c) 64 : 27 (d) 8 : 1

291. A hemisphere and a cone have equal bases. If their heights are also equal, then the ratio of their curved surfaces will be **[SSC—CHSL (10+2) Exam, 2015]**

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

292. The base of a right prism is a trapezium whose lengths of two parallels sides are 10 cm and 6cm and distance between them is 5 cm. If the heights of the prism is 8cm, its volume is

(a) 320 cm^3 (b) 300 cm^3
(c) 310 cm^3 (d) 300.5 cm^3

[SSC—CHSL (10+2) Exam, 2015]

293. The sum of the radius and the height of a cylinder is 19 m. The total surface area of the cylinder is 1672m^2, what is the volume of the cylinder? (in m^3)

[IBPS—Bank PO (Pre.) Exam, 2015]

(a) 3080 (b) 2940
(c) 3220 (d) 2660
(e) 2800

294. A solid piece of iron is in the form of a cuboids of dimensions (49cm × 33cm × 24cm) is melted and moulded to form a solid sphere. The radius of the sphere is

(a) 19cm (b) 21cm
(c) 23cm (d) 25cm

[DMRC—Train Operator (Station Controller) Exam, 2016]

295. A patient in a hospital is given soup daily in a cylindrical bowl of diameter 7 cm. If the bowl is filled with soup to a height of 4 cm. How much soup the hospital has to prepare daily to serve 250 patients? **[CLAT 2016]**

(a) 38L (b) 40L
(c) 39.5L (d) 35.5L

296. A sphere and a cube have same surface area. The ratio of squares of their volumes is **[CDS, 2016]**

(*a*) 6 : π (*b*) 5 : π
(*c*) 3 : 5 (*d*) 1 : 1

297. The radius of a sphere is equal to the radius of the base of a right circular cone, and the volume of the sphere is double the volume of the cone. The ratio of the height of the cone to the radius of its base is **[CDS, 2016]**

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

298. A rectangular paper of 44 cm long and 6 cm wide is rolled to form a cylinder of height equal to width of the paper. The radius of the base of the cylinder so rolled is **[CDS, 2016]**

(*a*) 3.5 cm (*b*) 5 cm
(*c*) 7 cm (*d*) 14 cm

299. If three metallic spheres of radii 6 cm, 8 cm and 10 cm are melted to form a single sphere, then the diameter of the new sphere will be **[CDS, 2016]**

(*a*) 12 cm (*b*) 24 cm
(*c*) 30 cm (*d*) 36 cm

300. If the height of a right circular cone is increased by 200% and the radius of the base is reduced by 50%, then the volume of the cone **[CDS, 2016]**

(*a*) remains unaltered (*b*) decrease by 25%
(*c*) increase by 25% (*d*) increase by 50%

301. If the radius of a sphere is increased by 10%, then the volume will be increased by **[CDS, 2016]**

(*a*) 33.1% (*b*) 30%
(*c*) 50% (*d*) 10%

302. When a ball bounces, it rises to $\frac{2}{3}$ of the height from which it fell. If the ball is dropped from a height of 36 m, how high will it rise at the third bounce? **[CDS, 2016]**

(*a*) $10\frac{1}{3}$ m (*b*) $10\frac{2}{3}$ m
(*c*) $12\frac{1}{3}$ m (*d*) $12\frac{2}{3}$ m

303. A swimming pool 9m wide and 12m long and 1m deep on the shallow side and 4m deep on the deeper side. Its volume is **[DMRC—Customer Relations Assistant (CRA) Exam, 2016]**

(*a*) 360 m^3 (*b*) 270 m^3
(*c*) 420 m^3 (*d*) None of these

304. A metal cube of edge 12 cm is melted and formed into three smaller cubes. If the edges of two smaller cubes are 6cm and 8cm, find the edges of the third smaller cube. **[DMRC—Jr. Engineer (Electrical) Exam 2016]**

(*a*) 8 cm (*b*) 10 cm
(*c*) 12 cm (*d*) None of these

ANSWERS

1. (c)	2. (d)	3. (d)	4. (b)	5. (d)	6. (b)	7. (a)	8. (a)	9. (b)	10. (a)
11. (b)	12. (b)	13. (b)	14. (a)	15. (b)	16. (a)	17. (b)	18. (d)	19. (c)	20. (c)
21. (c)	22. (b)	23. (b)	24. (c)	25. (c)	26. (c)	27. (b)	28. (b)	29. (b)	30. (c)
31. (c)	32. (d)	33. (b)	34. (c)	35. (c)	36. (c)	37. (c)	38. (b)	39. (c)	40. (b)
41. (b)	42. (d)	43. (c)	44. (b)	45. (b)	46. (c)	47. (a)	48. (b)	49. (b)	50. (a)
51. (d)	52. (c)	53. (a)	54. (b)	55. (b)	56. (a)	57. (a)	58. (d)	59. (a)	60. (d)
61. (c)	62. (d)	63. (b)	64. (d)	65. (d)	66. (c)	67. (b)	68. (d)	69. (c)	70. (d)
71. (d)	72. (a)	73. (d)	74. (c)	75. (b)	76. (c)	77. (d)	78. (c)	79. (c)	80. (b)
81. (d)	82. (b)	83. (d)	84. (b)	85. (c)	86. (c)	87. (b)	88. (b)	89. (d)	90. (d)
91. (d)	92. (c)	93. (b)	94. (d)	95. (b)	96. (c)	97. (b)	98. (c)	99. (d)	100. (c)
101. (d)	102. (c)	103. (d)	104. (b)	105. (d)	106. (d)	107. (b)	108. (b)	109. (d)	110. (c)
111. (c)	112. (c)	113. (c)	114. (b)	115. (a)	116. (b)	117. (c)	118. (d)	119. (d)	120. (b)
121. (b)	122. (b)	123. (d)	124. (a)	125. (b)	126. (c)	127. (b)	128. (d)	129. (c)	130. (d)
131. (c)	132. (c)	133. (b)	134. (c)	135. (c)	136. (d)	137. (a)	138. (b)	139. (c)	140. (c)
141. (c)	142. (d)	143. (a)	144. (b)	145. (c)	146. (b)	147. (b)	148. (c)	149. (b)	150. (d)
151. (b)	152. (d)	153. (b)	154. (c)	155. (b)	156. (b)	157. (c)	158. (c)	159. (d)	160. (c)
161. (b)	162. (b)	163. (d)	164. (d)	165. (c)	166. (a)	167. (c)	168. (b)	169. (c)	170. (c)
171. (b)	172. (b)	173. (d)	174. (c)	175. (c)	176. (c)	177. (b)	178. (d)	179. (d)	180. (b)

181. (a)	182. (a)	183. (d)	184. (b)	185. (d)	186. (c)	187. (a)	188. (c)	189. (c)	190. (b)
191. (c)	192. (b)	193. (d)	194. (c)	195. (d)	196. (b)	197. (a)	198. (d)	199. (c)	200. (d)
201. (a)	202. (c)	203. (a)	204. (d)	205. (c)	206. (d)	207. (b)	208. (a)	209. (c)	210. (b)
211. (c)	212. (d)	213. (d)	214. (c)	215. (b)	216. (d)	217. (d)	218. (c)	219. (d)	220. (d)
221. (c)	222. (b)	223. (c)	224. (a)	225. (d)	226. (d)	227. (a)	228. (b)	229. (a)	230. (d)
231. (d)	232. (c)	233. (c)	234. (d)	235. (c)	236. (c)	237. (b)	238. (d)	239. (a)	240. (b)
241. (d)	242. (b)	243. (b)	244. (c)	245. (a)	246. (d)	247. (b)	248. (c)	249. (d)	250. (d)
251. (c)	252. (c)	253. (d)	254. (a)	255. (c)	256. (a)	257. (b)	258. (c)	259. (c)	260. (c)
261. (b)	262. (b)	263. (b)	264. (c)	265. (c)	266. (a)	267. (b)	268. (a)	269. (c)	270. (d)
271. (b)	272. (b)	273. (b)	274. (d)	275. (b)	276. (b)	277. (c)	278. (b)	279. (d)	280. (c)
281. (b)	282. (d)	283. (c)	284. (b)	285. (c)	286. (c)	287. (a)	288. (a)	289. (b)	290. (c)
291. (a)	292. (a)	293. (a)	294. (b)	295. (d)	296. (a)	297. (a)	298. (c)	299. (b)	300. (b)
301. (a)	302. (b)	303. (b)	304. (b)						

SOLUTIONS

3. Volume of the tank = $(8 \times 100 \times 6 \times 100 \times 2.5 \times 100)$ cm^3 = 120000000 cm^3

$= \left(\frac{120000000}{1000}\right)$ litres = 120000 litres.

4. Surface area = $[2(7 \times 11 + 11 \times 13 + 7 \times 13)]$ cm^2

$= (2 \times 311)$ cm^2 = 622 cm^2.

5. Total length of tape required = Sum of lengths of edges = $(30 \times 4 + 25 \times 4 + 20 \times 3)$ cm = 300 cm.

6. Required number of bags =

$\frac{\text{Volume of the room}}{\text{Volume of each bag}} = \frac{15 \times 10 \times 8}{2.25} = 533.333 \approx 533.$

7. Volume of the reservoir = 42000 litres = 42 m^3.

Let the depth of the reservoir be h metres.

Then, $6 \times 3.5 \times h = 42$ or $h = \frac{42}{6 \times 3.5} = 2$ m.

8. Area of the wet surface = $[2(lb + bh + lh) - lb]$

$= 2(bh + lh) + lb$

$= [2(4 \times 1.25 + 6 \times 1.25) + 6 \times 4]$ m^2 = 49 m^2.

9. Volume of water displaced = $(3 \times 2 \times 0.01)$ m^3 = 0.06 m^3.

$\therefore$ Mass of man = Volume of water displaced $\times$ Density of water = (0.06×1000) kg = 60 kg.

10. Since the tank is open at the top, we have:

Area of sheet required = Surface area of the tank

$= lb + 2(bh + lh)$

$= [30 \times 20 + 2(20 \times 12 + 30 \times 12)]$ m^2 = $(600 + 1200)$ m^2 = 1800 m^2.

Length of sheet required = $\left(\frac{\text{Area}}{\text{Width}}\right) = \left(\frac{1800}{3}\right)$ m = 600 m.

$\therefore$ Cost of the sheet = ₹ (600×10) = ₹ 6000.

11. Let length = x cm. Then,

$x \times 28 \times 5 \times \frac{25}{1000} = 112 \Rightarrow x = \left(112 \times \frac{1000}{25} \times \frac{1}{28} \times \frac{1}{5}\right)$ cm = 32 cm.

12. Volume of gold = $\left(\frac{1}{2} \times 100 \times 100 \times 100\right)$ cm^3.

Area of sheet = 10000 m^2 = $(10000 \times 100 \times 100)$ cm^2.

$\therefore$ Thickness of the sheet =

$\left(\frac{1 \times 100 \times 100 \times 100}{2 \times 10000 \times 100 \times 100}\right)$ cm = 0.005 cm.

13. Area = (1.5×10000) m^2 = 15000 m^2. Depth = $\frac{5}{100}$ m = $\frac{1}{20}$ m.

$\therefore$ Volume = (Area $\times$ Depth) = $\left(15000 \times \frac{1}{20}\right)$ m^3 = 750 m^3.

14. Let the height of the room be x metres.

Then, breadth = $2x$ metres and length = $4x$ metres.

$\therefore$ Volume of the room = $(4x \times 2x \times x)$ m^3 = $(8x^3)$ m^3.

$8x^3 = 512 \Rightarrow x^3 = 64 \Rightarrow x = 4.$

Length of the room is 16 m.

15. Let the breadth be x metres. Then, length = $2x$ metres.

Area of 4 walls = $[2(2x + x) \times 3]$m^2 = $(18x)$ m^2.

$\therefore 18x = 108 \Rightarrow x = \frac{108}{18} = 6.$

So, length = 12 m, breadth = 6 m.

Volume = $(12 \times 6 \times 3)$ m^3 = 216 m^3.

16. Let the height of the hall be h metres.

Then, $2 \times 20 \times 16 = 2(20 + 16) \times h \Rightarrow 72h = 640$

$\Rightarrow h = \frac{640}{72} = \frac{80}{9}.$

$\therefore$ Volume of the hall

$= \left(20 \times 16 \times \frac{80}{9}\right)$ m^3 = $\left(\frac{25600}{9}\right)$ m^3 = 2844.4 m^3.

17. $V = abc.$

$S = 2(ab + bc + ca) = 2abc\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)$

$\Rightarrow S = 2V\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right) \Rightarrow \frac{1}{V} = \frac{2}{S}\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$.

18. Let the dimensions be $3x$, $2x$ and x respectively. Then,

$3x \times 2x \times x = 10368 \Leftrightarrow x^3 = \left(\frac{10368}{6}\right) = 1728 \Leftrightarrow x = 12.$

So, the dimensions of the block are 36 dm, 24 dm and 12 dm.

Surface area $= [2\,(36 \times 24 + 24 \times 12 + 36 \times 12)]\ \text{dm}^2$
$= [2 \times 144\,(6 + 2 + 3)]\ \text{dm}^2 = 3168\ \text{dm}^2$.

$\therefore$ Cost of polishing $= ₹\left(\frac{2 \times 3168}{100}\right) = ₹\ 63.36.$

19. Let the length, breadth and height of the box be $2x$, $3x$ and $4x$ respectively.

Then, surface area of the box $= 2[2x.3x + 3x.4x + 2x.4x]$
$= [2(6x^2 + 12x^2 + 8x^2)] = 52x^2$.

$\therefore 52x^2 = \frac{1248}{1.50} = 832 \Rightarrow x^2 = \frac{832}{52} = 16 \Rightarrow x = \sqrt{16} = 4.$

Hence, the dimensions of the box are 8 m, 12 m and 16 m.

20. Volume of the hall $= (500 \times 22.5)\ \text{m}^3 = 11250\ \text{m}^3$.

Let the length and breadth of the hall be l and b metres respectively.

Then, $l \times b \times h = 11250 \Rightarrow lb = \frac{11250}{7.5} = 1500$ ...(i)

And, $2(l + b) \times h = 1200 \Rightarrow 2\,(l + b) = \frac{1200}{7.5} = 160$

$\Rightarrow l + b = 80$ ...(*ii*)

Putting $b = (80 - l)$ in (*i*), we get:

$l\,(80 - l) = 1500 \Rightarrow l^2 - 80l + 1500 = 0 \Rightarrow (l - 30)\,(l - 50) = 0 \Rightarrow l = 50.$

Hence, length = 50 m, breadth = 30 m.

21. Let the length of the tank be x dm. Then, depth of the tank $= \frac{x}{3}$ dm.

Breadth of the tank

$= \left[\frac{1}{2} \text{ of } \frac{1}{3} \text{ of } \left(x - \frac{x}{3}\right)\right] \text{dm} = \left(\frac{1}{2} \times \frac{1}{3} \times \frac{2x}{3}\right) \text{dm} = \frac{x}{9} \text{ dm}.$

$\therefore\ x \times \frac{x}{9} \times \frac{x}{3} = 216 \Rightarrow x^3 = 216 \times 27 \Rightarrow x = 6 \times 3 = 18.$

22. Required length $= \sqrt{(10)^2 + (10)^2 + (5)^2}\ \text{m} = \sqrt{225}\ \text{m} = 15\ \text{m}.$

23. Required length

$= \sqrt{(16)^2 + (12)^2 + \left(\frac{32}{3}\right)^2}\ \text{m} = \sqrt{256 + 144 + \frac{1024}{9}}\ \text{m}$

$= \sqrt{\frac{4624}{9}}\ \text{m} = \frac{68}{3}\ \text{m} = 22\frac{2}{3}\ \text{m}.$

24. Let l, b and h represent the lengths of the edges of the solid. Then, $l \times b = 42$ ...(*i*)

$lbh = 210 \Rightarrow h = \frac{210}{lb} = \frac{210}{42} \Rightarrow h = 5.$

Surface area $= 2(lb + bh + lh) = 2(42 + 5b + 5l)$
$= 84 + 10(l + b).$

$\therefore 84 + 10(l + b) = 214 \Rightarrow l + b = 13.$ ...(*ii*)

Putting $b = (13 - l)$ in (*i*), we get: $l(13 - l) = 42 \Rightarrow l^2 - 13l + 42 = 0 \Rightarrow (l - 6)\,(l - 7) = 0$
$\Rightarrow l = 7.$

Hence, length = 7 cm, breadth = 6 cm, height = 5 cm.

25. Number of bricks =

$\frac{\text{Volume of the wall}}{\text{Volume of 1 brick}} = \left(\frac{800 \times 600 \times 22.5}{25 \times 11.25 \times 6}\right) = 6400.$

26. Volume of the bricks = 95% of volume of wall

$= \left(\frac{95}{100} \times 600 \times 500 \times 50\right) \text{cm}^3.$

Volume of 1 brick $= (25 \times 12.5 \times 7.5)\ \text{cm}^3$.

$\therefore$ Number of bricks $= \left(\frac{95}{100} \times \frac{600 \times 500 \times 50}{25 \times 12.5 \times 7.5}\right) = 6080.$

27. Total volume of water displaced $= (4 \times 50)\ \text{m}^3 = 200\ \text{m}^3$.

$\therefore$ Rise in water level $= \left(\frac{200}{40 \times 20}\right) \text{m} = 0.25\ \text{m} = 25\ \text{cm}.$

28. Volume of water displaced $= \left(24 \times 15 \times \frac{1}{100}\right) \text{m}^3 = \frac{18}{5} \text{m}^3.$

Volume of water displaced by 1 man $= 0.1\ \text{m}^3$.

$\therefore$ Number of men $= \left(\frac{18/5}{0.1}\right) = \left(\frac{18}{5} \times 10\right) = 36.$

29. Let the breadth and height of the room be b and h metres respectively.

Then, area of the floor $= (14b)\ \text{m}^2$.

$\therefore 14b = 2.2 \times 70 \Rightarrow b = \frac{2.2 \times 70}{14} = 11.$

Volume of the room $= (14 \times 11 \times h)\ \text{m}^3 = (154h)\ \text{m}^3$.

$\therefore 154h = 11 \times 70 \Rightarrow h = \frac{11 \times 70}{154} = 5.$

30. Volume of earth dug out $= (5 \times 4.5 \times 2.1)\ \text{m}^3 = 47.25\ \text{m}^3$.

Area over which earth is spread $= (13.5 \times 2.5 - 5 \times 4.5)\ \text{m}^2 = (33.75 - 22.5)\ \text{m}^2 = 11.25\ \text{m}^2$.

$\therefore$ Rise in level $= \frac{\text{Volume}}{\text{Area}} = \left(\frac{47.25}{11.25}\right) \text{m} = 4.2\ \text{m}.$

31. Volume of earth dug out $= (240 \times 180 \times 0.25)\ \text{m}^3$
$= 10800\ \text{m}^3$.

Let the depth of the drainlet be h metres.

Then, volume of earth dug out
$= [\{(260 \times 200) - (240 \times 180)\}h]\ \text{m}^3 = (8800h)\ \text{m}^3$.

$\therefore 8800h = 10800 \Rightarrow h = \frac{10800}{8800} = \frac{27}{22} = 1.227\ \text{m}.$

32. Let the depth of the cistern be h metres.

Then, $4.5 \times 3 \times h = 50 \Rightarrow h = \frac{50}{13.5} = \frac{100}{27}.$

Area of sheet required $= lb + 2\,(bh + lh) = lb + 2h\,(l + b)$

$= \left[4.5 \times 3 + 2 \times \frac{100}{27}(4.5 + 3)\right] \text{m}^2$

$= \left(13.5 + \frac{200}{27} \times 7.5\right) \text{m}^2 = \left(\frac{27}{2} + \frac{500}{9}\right) \text{m}^2 = \frac{1243}{18}\ \text{m}^2.$

$\therefore$ Weight of lead $= \left(27 \times \frac{1243}{18}\right) \text{kg} = \left(\frac{3729}{2}\right) \text{kg} = 1864.5\ \text{kg}.$

33. Length of water column flown in 1 min

$$= \left(\frac{3.6 \times 1000}{60}\right) \text{m} = 60 \text{ m}.$$

$\therefore$ Volume flown per minute = $(60 \times 45 \times 2.5)$ m^3 = 6750 m^3.

34. Length of water column flown in 1 min.

$$= \left(\frac{10 \times 1000}{60}\right) \text{m} = \frac{500}{3} \text{ m}.$$

Volume flown per minute = $\left(\frac{500}{3} \times \frac{40}{100 \times 100}\right) \text{m}^3 = \frac{2}{3} \text{m}^3$.

Volume flown in half an hour = $\left(\frac{2}{3} \times 30\right) \text{m}^3 = 20 \text{ m}^3$.

$\therefore$ Rise in water level = $\left(\frac{20}{40 \times 80}\right) \text{m} = \left(\frac{1}{160} \times 100\right) \text{cm} = \frac{5}{8}$ cm.

35. Volume flown in 5 hours = $\left(225 \times 162 \times \frac{20}{100}\right) \text{m}^3 = 7290 \text{ m}^3$.

Volume flown in 1 hour = $\left(\frac{7290}{5}\right) \text{m}^3 = 1458 \text{ m}^3$.

$\therefore$ Required speed = $\left(\frac{1458}{0.60 \times 0.45}\right) \text{m/hr} = 5400 \text{ m/hr}$.

36. Volume of water in the reservoir = $(80 \times 60 \times 6.5)$ m^3
= 31200 m^3.

Volume of water flowing out per hour

$$= \left(15000 \times \frac{20}{100} \times \frac{20}{100}\right) \text{m}^3 = 600 \text{ m}^3.$$

$\therefore$ Total time taken to empty the tank = $\left(\frac{31200}{600}\right)$ hrs = 52 hrs.

37. Let l, b and h denote the length, breadth and depth of Meeta's lunch box.

Then, length of Rita's lunch box = 110% of $l = \frac{11l}{10}$.

breadth of Rita's lunch box = 110% of $b = \frac{11b}{10}$.

depth of Rita's lunch box = 80% of $h = \frac{4h}{5}$.

$\therefore$ Ratio of the capacities of Rita's and Meeta's lunch boxes = $\frac{11l}{10} \times \frac{11b}{10} \times \frac{4h}{5} : lbh = \frac{121}{125} : 1$ = 121 : 125.

38. $(l + b + h) = 19$ and

$\sqrt{l^2 + b^2 + h^2} = 5\sqrt{5}$ and so $(l^2 + b^2 + h^2) = 125$.

Now, $(l + b + h)^2 = 19^2 \Rightarrow (l^2 + b^2 + h^2) + 2(lb + bh + lh) = 361$

$\Rightarrow 2(lb + bh + lh) = (361 - 125) = 236$.

$\therefore$ Surface area = 236 cm^2.

39. Sum of perimeters of the six faces

= $2[2(l + b) + 2(b + h) + 2(l + h)]$
= $4(2l + 2b + 2h) = 8(l + b + h)$.

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

$\therefore 8(l + b + h) = 72$ and $2(lb + bh + lh) = 16 \Rightarrow l + b + h = 9$ and $lb + bh + lh = 8$.

Now, $(l + b + h)^2 = l^2 + b^2 + h^2 + 2(lb + bh + lh)$

$\Rightarrow 9^2 = l^2 + b^2 + h^2 + 16 \Rightarrow l^2 + b^2 + h^2 = 81 - 16 = 65$.

Required length = $\sqrt{l^2 + b^2 + h^2} = \sqrt{65} = 8.05$ cm.

40. Volume

$$= \left[12 \times 9 \times \left(\frac{1+4}{2}\right)\right] \text{m}^3 = (12 \times 9 \times 2.5) \text{ m}^3 = 270 \text{ m}^3.$$

41. Let the original length, breadth and height of the solid be l, b and h respectively.

Original volume = (lbh) cu. units.

New length = 110% of $l = \frac{11l}{10}$.

New breadth = 90% of $b = \frac{9b}{10}$.

New volume = $\left(\frac{11l}{10} \times \frac{9b}{10} \times h\right)$ cu. units = $\left(\frac{99}{100} lbh\right)$ cu. units.

Decrease = $\left(lbh - \frac{99}{100} lbh\right) = \frac{lbh}{100}$.

$\therefore$ Decrease% = $\left(\frac{lbh}{100} \times \frac{1}{lbh} \times 100\right)\% = 1\%$.

42. Let the original length, breadth and height of the cuboid be x, $2x$ and $3x$ units respectively.

Then, original volume = $(x \times 2x \times 3x)$ cu. units = $6x^3$ cu. units.

New length = 200% of $x = 2x$,

New breadth = 300% of $2x = 6x$,

New height = 300% of $3x = 9x$.

$\therefore$ New volume = $(2x \times 6x \times 9x)$ cu. units
= $108 x^3$ cu. units.

Increase in volume = $(108 x^3 - 6x^3)$ cu. units
= $(102x^3)$ cu. units

$\therefore$ Required ratio = $\frac{102x^3}{6x^3} = 17$.

43. Clearly, $l = (18 - 10)$ cm = 8 cm, $b = (24 - 10)$ cm = 14 cm, h = 5 cm.

$\therefore$ Volume of the box = $(8 \times 14 \times 5)$ cm^3 = 560 cm^3.

44. Clearly, $l = (20 - 4)$ cm = 16 cm, $b = (15 - 4)$ cm = 11 cm, h = 2cm

$\therefore$ Outer surface area of the box = $[2(l + b) \times h] + lb$
= $[\{2(16 + 11) \times 2\} + 16 \times 11]$ cm^2
= $(108 + 176)$ cm^2 = 284 cm^2.

45. Internal length = $(12 - 2)$ cm = 10 cm,

Internal breadth = $(10 - 2)$ cm = 8 cm,

Internal height = $(8 - 2)$ cm = 6 cm.

Inner surface area = $2[10 \times 8 + 8 \times 6 + 10 \times 6]$ cm^2
= (2×188) cm^2 = 376 cm^2.

46. The external measures of the box are $(115 + 5)$ cm, $(75 + 5)$ cm and $(35 + 5)$ cm *i.e.*, 120 cm, 80 cm and 40 cm.

Volume of the wood = External volume – Internal volume
= $[(120 \times 80 \times 40) - (115 \times 75 \times 35)]$ cm^3
= $(384000 - 301875)$ cm^3 = 82125 cm^3.

47. Since the box is an open one, we have:

Internal length = $(52 - 4)$ cm = 48 cm;

Internal breadth = $(40 - 4)$ cm = 36 cm;

Internal depth = $(29 - 2)$ cm = 27 cm.

Volume of the metal used in the box = External volume – Internal volume
= $[(52 \times 40 \times 29) - (48 \times 36 \times 27)]$ cm^3

$= (60320 - 46656)\ cm^3 = 13664\ cm^3$.

$\therefore$ Weight of the box $= \left(\frac{13664 \times 0.5}{1000}\right)$ kg $= 6.832$ kg.

48. Internal length $= (146 - 6)$ cm $= 140$ cm.
Internal breadth $= (116 - 6)$ cm $= 110$ cm.
Internal depth $= (83 - 3)$ cm $= 80$ cm.
Area of inner surface $= [2\ (l + b) \times h] + lb$
$= [2\ (140 + 110) \times 80 + 140 \times 110]\ cm^2 = 55400\ cm^2$.

$\therefore$ Cost of painting $= ₹\left(\frac{1}{2} \times \frac{1}{100} \times 55400\right) = ₹\ 277.$

49. Let the thickness of the bottom be x cm.
Then, $[(330 - 10) \times (260 - 10) \times (110 - x)] = 8000 \times 1000$
$\Leftrightarrow 320 \times 250 \times (110 - x) = 8000 \times 1000$

$\Leftrightarrow\ (110 - x) = \frac{8000 \times 1000}{320 \times 250} = 100$

$\Leftrightarrow x = 10$ cm $= 1$ dm.

50. Let the dimensions of the bigger cuboid be x, y and z.
Then, Volume of the bigger cuboid $= xyz$.
Vlume of the miniature cuboid

$= \left(\frac{1}{4}x\right)\left(\frac{1}{4}y\right)\left(\frac{1}{4}z\right) = \frac{1}{64}xyz.$

$\therefore$ Weight of the miniature cuboid $= \left(\frac{1}{64} \times 16\right)$ kg $= 0.25$ kg.

51. Depth of the tank $= \left(\frac{24}{4 \times 3}\right)$m $= 2$ m.

Since the tank is open and thickness of material is to be ignored, we have
Sum of inner and outer surfaces $= 2[\{2(l + b) \times h\} + lb]$
$= 2[\{2\ (4 + 3) \times 2\} + 4 \times 3]\ m^2 = 80\ m^2$.

$\therefore$ Cost of painting $= ₹\ (80 \times 10) = ₹\ 800$.

52. Let length $= l$, breadth $= b$, height $= h$. Then, $x = lb$, $y = bh$, $z = lh$.
Let V be the volume of the cuboid. Then, $V = lbh$.

$\therefore xyz = lb \times bh \times lh = (lbh)^2 = V^2$ or $V = \sqrt{xyz}$.

53. Let the length, breadth and height of the box be l, b and h respectively. Then,
Volume

$= lbh = \sqrt{(lbh)^2} = \sqrt{lb \times bh \times lh} = \sqrt{120 \times 72 \times 60} = 720\ cm^3$.

54. Let $lb = 2x$, $bh = 3x$ and $lh = 4x$.
Then, $24x^3 = (lbh)^2 = 9000 \times 9000 \Rightarrow x^3 = 375 \times 9000$
$\Rightarrow x = 150$.
So, $lb = 300$, $bh = 450$, $lh = 600$ and $lbh = 9000$.

$\therefore h = \frac{9000}{300} = 30, l = \frac{9000}{450} = 20$ and $b = \frac{9000}{600} = 15.$

Hence, shortest side $= 15$ cm.

55. Sum of original dimensions $= 48 + 30 + 52 = 130$.
Increase in sum $= 156 - 130 = 26$.
Since the dimensions have been increased proportionately,

so increase in shortest side $= \left(26 \times \frac{30}{130}\right)'' = 6''.$

56. Let the length of the new slab be x metres.

Then, $1 \times 0.20 \times 0.01 = x \times 0.001 \times 1 \Rightarrow x = \frac{0.002}{0.001} = 2.$

$\therefore$ Required length $= 2$ m $= 200$ cm.

57. Clearly, payment shall be made in proportion to the volume of earth dug.

$\frac{\text{Volume actually dug}}{\text{Volume to be dug as settled}} = \frac{2 \times (5 \times 5 \times 5)}{10 \times 10 \times 10} = \frac{1}{4}.$

$\therefore$ Payment to be made $= \frac{1}{4} \times 40000 = 10000.$

58. Volume of the cube $= 8^3$ cu. m $= 512$ cu. m

59. Edge of the cube $= \left(\frac{20}{4}\right)$cm $= 5$ cm.

$\therefore$ Volume $= (5 \times 5 \times 5)\ cm^3 = 125\ cm^3$.

60. Surface area $= \left[6 \times \left(\frac{1}{2}\right)^2\right] cm^2 = \frac{3}{2}\ cm^2.$

61. Surface area of the cube $= (6 \times 8^2)$ sq. ft. $= 384$ sq. ft.

Quantity of paint required $= \left(\frac{384}{16}\right)$ kg $= 24$ kg.

$\therefore$ Cost of painting $= ₹\ (36.50 \times 24) = ₹\ 876$.

62. $a^3 = 729 \Rightarrow a = \sqrt[3]{729} = 9$.

$\therefore$ Surface area $= 6a^2 = (6 \times 9 \times 9)\ cm^2 = 486\ cm^2$.

63. $6a^2 = 150 \Rightarrow a^2 = 25 \Rightarrow a = 5$. $\therefore$ Volume $= a^3 = 5^3\ cm^3$
$= 125\ cm^3$.

64. Volume of the cube $= (270 \times 100 \times 64)\ cm^3$.
Edge of the cube $=$

$\sqrt[3]{270 \times 100 \times 64}$ cm $= (3 \times 10 \times 4)$ cm $= 120$ cm.

$\therefore$ Surface area $= (6 \times 120 \times 120)\ cm^2 = 86400\ cm^2$.

65. Surface area $= \left(\frac{34398}{13}\right) = 2646\ cm^2.$

$\therefore 6a^2 = 2646 \Rightarrow a^2 = 441 \Rightarrow a = 21$.
So, Volume $= (21 \times 21 \times 21)\ cm^3 = 9261\ cm^3$.

66. Volume of cube $=$ Volume of sheet $= (27 \times 8 \times 1)\ cm^3 = 216\ cm^3$.

Edge of cube $= \sqrt[3]{216}$ cm $= 6$ cm.

Surface area of sheet$= 2(lb + bh + lh) = 2\ (27 \times 8 + 8 \times 1 + 27 \times 1)\ cm^2$.
$= (216 + 8 + 27)\ cm^2 = 502\ cm^2$.
Surface area of cube $= 6a^2 = (6 \times 6^2)\ cm^2 = 216\ cm^2$.
$\therefore$ Required difference $= (502 - 216)\ cm^2 = 286\ cm^2$.

67. Required length $=$ Diagonal $= \sqrt{3}\,a = (\sqrt{3} \times \sqrt{3})$ m $= 3$ m.

68. $\sqrt{3}\,a = 4\sqrt{3} \Rightarrow a = 4$.

$\therefore$ Volume $= (4 \times 4 \times 4)\ cm^3 = 64\ cm^3$.

69. Since a cube has 4 diagonals, we have: Length of a diagonal $= \left(\frac{12}{4}\right)$cm $= 3$ cm.

Let the length of each edge of the cube be a cm.
Then, $\sqrt{3}a = 3$ or $a = \sqrt{3}$.

$\therefore$ Total length of the edges of the cube $= 12\sqrt{3}$ cm.

70. $6a^2 = 13254 \Rightarrow a^2 = 2209 \Rightarrow a = \sqrt{2209} = 47$.

$\therefore$ Length of diagonal $= \sqrt{3}\,a = 47\sqrt{3}$ cm.

71. Clearly, we have:
$V_1 = x^3$, $V_2 = (2x)^3 = 8x^3$, $V_3 = (3x)^3 = 27x^3$,
$V_4 = (4x)^3 = 64x^3$.
(1) $V_1 + V_2 + 2V_3 = x^3 + 8x^3 + 2 \times 27x^3 = 63x^3 < V_4$.
(2) $V_1 + 4V_2 + V_3 = x^3 + 4 \times 8x^3 + 27x^3 = 60x^3 < V_4$.
(3) $2(V_1 + V_3) + V_2 = 2(x^3 + 27x^3) + 8x^3 = 64x^3 = V_4$.

72. Volume of the remaining solid = Volume of the cube − Volume of the cuboid cut out from it
$= [(8 \times 8 \times 8) - (3 \times 3 \times 8)]\ m^3 = (512 - 72)\ m^3 = 440\ m^3$.

73. $a^3 = 6a^2 \Rightarrow a = 6$.

74. $a^3 = 12a \Rightarrow a^2 = 12 \Rightarrow 6a^2 = (6 \times 12)$ sq. units
$= 72$ sq. units.

75. Clearly, each of the 5 faces of the given cube are glued to a face of another cube.
$\therefore$ Total surface area of the solid $5 \times 5a^2 + a^2 = 26a^2$
$= (26 \times 3^2)\ cm^2 = 234\ cm^2$.

76. Let the length of each side of the cube be a cm.
Then, volume of the part of cube outside water = volume of the mass placed on it
$\Rightarrow 2a^2 = 0.2 \times 1000 = 200 \Rightarrow a^2 = 100 \Rightarrow a = 10$.

77. Volume of the bigger cube $= (8^3)\ cm^3 = 512\ cm^3$.
Volume of the cut-out cube $= (1^3)\ cm^3 = 1\ cm^3$.
Volume of the remaining portion $= (512 - 1)\ cm^3$
$= 511\ cm^3$.

$$\frac{\text{Weight of the remaining portion}}{\text{Weight of the original cube}} = \frac{511}{512}.$$

78. Number of cubes $= \left(\dfrac{100 \times 100 \times 100}{10 \times 10 \times 10}\right) = 1000$.

79. Number of small cubes formed $= \left(\dfrac{4 \times 4 \times 4}{1 \times 1 \times 1}\right) = 64$.
Total surface area of the small cubes $= [64 \times (6 \times 1^2)]\ cm^2 = 384\ cm^2$.

80. Clearly, when the rectangular block was cut into 2 identical cubes, two new faces were formed – one on each cube along the line of the cut. So, the difference in surface areas is equal to the surface area of the newly formed faces.

Volume of each cube $= \left(\dfrac{250}{2}\right) cm^3 = 125\ cm^3$.

Edge of each cube $= \sqrt[3]{125}\ cm = 5\ cm$.
Hence, difference in surface areas $= (2 \times 5^2)\ cm^2 = 50\ cm^2$.

81. Number of blocks $= \left(\dfrac{160 \times 100 \times 60}{20 \times 20 \times 20}\right) = 120$.

82. Number of cubes $= \left(\dfrac{18 \times 18 \times 18}{3 \times 3 \times 3}\right) = 216$.

83. Number of cubes formed $= \dfrac{10^3 \times 10^3 \times 10^3}{1 \times 1 \times 1} = 10^9$.

$\therefore$ Total length of cube-robe $= (1 \times 10^9)$ mm $= 10^9$ mm
$= \left(\dfrac{10^9}{10^6}\right) km = 10^3\ km = 1000\ km$.

84. Let the length of each edge of small cube be a_1 and that of large cube be a_2.
Then, $6a_1^2 = 96$ and $6a_2^2 = 384 \Rightarrow a_1^2 = 16$ and $a_2^2 = 64$
$\Rightarrow a_1 = 4$ and $a_2 = 8$.

$\therefore$ Number of cubes formed $= \dfrac{\text{Volume of larger cube}}{\text{Volume of smaller cube}}$
$= \left(\dfrac{8 \times 8 \times 8}{4 \times 4 \times 4}\right) = 8$.

85. Volume of the cuboid $= (9 \times 8 \times 6)\ cm^3 = 432\ cm^3$.
Volume of the cube $= \left(\dfrac{1}{2} \times 432\right) cm^3 = 216\ cm^3$.
$a^3 = 216 \Rightarrow a = \sqrt[3]{216} = 6 \Rightarrow 6a^2 = (6 \times 6^2) = 216$.

86. Volume of block $= (6 \times 9 \times 12)\ cm^3 = 648\ cm^3$.
Side of largest cube = H.C.F. of 6 cm, 9 cm, 12 cm
= 3 cm.
Volume of this cube $= (3 \times 3 \times 3)$ cm $= 27\ cm^3$.
$\therefore$ Number of cubes $= \left(\dfrac{648}{27}\right) = 24$.

87. Side of smallest cube = L.C.M. of 5 cm, 10 cm, 20 cm = 20 cm.
Volume of the cube $= (20 \times 20 \times 20)\ cm^3 = 8000\ cm^3$.
Volume of the block $= (5 \times 10 \times 20)\ cm^3 = 1000\ cm^3$.
$\therefore$ Number of blocks $= \left(\dfrac{8000}{1000}\right) = 8$.

88. Let the sides of the sheet be x and $5x$. Then,
Volume of the sheet = Volume of the cube
$\Rightarrow x \times 5x \times \dfrac{1}{2} = 10 \times 10 \times 10 \Rightarrow 5x^2 = 2000 \Rightarrow x^2 = 400$
$\Rightarrow x = 20$.
$\therefore$ The sides are 20 cm and 100 cm.

89. Let the length of each edge of the cube be a.
Then, the dimensions of each of the two rectangular solids are a, a and $\dfrac{a}{2}$.
Surface area of each rectangular solid
$= 2\left[a \times a + a \times \dfrac{a}{2} + a \times \dfrac{a}{2}\right] = 4a^2$.
Surface area of unpainted face of each solid
$= (a \times a) = a^2$.
$\therefore$ Required percentage $= \left(\dfrac{a^2}{4a^2} \times 100\right)\% = 25\%$.

90. Let the other two dimensions of the cuboid be a and b cm respectively.
Then, $6ab = 216$ or $ab = 36$.
The possible values of (a, b) are (1, 36), (2, 18), (3, 12) and (4, 9).

91. Volume of the new cube $= (6^3 + 8^3 + 10^3)\ cm^3 = 1728\ cm^3$.
Let the edge of the new cube be a cm.
$\therefore a^3 = 1728 \Rightarrow a = 12$.
Hence, length of diagonal $= \sqrt{3}a = 12\sqrt{3}$ cm
$= (12 \times 1.732)$ cm $= 20.784$ cm ≈ 20.8 cm.

92. Volume of the larger cube $= (3^3 + 4^3 + 5^3)\ cm^3 = 216\ cm^3$.
Let the edge of the larger cube be a cm.
$\therefore a^3 = 216 \Rightarrow a = 6$.
Required ratio $= \dfrac{6(3^2 + 4^2 + 5^2)}{6 \times 6^2} = \dfrac{6 \times 50}{6 \times 36} = \dfrac{25}{18}$.

93. The new solid formed is a cuboid of length 25 cm, breadth 5 cm and height 5 cm.
$\therefore$ Volume $= (25 \times 5 \times 5)\ cm^3 = 625\ cm^3$.

94. Let the length of each edge of each cube be a.
Then, the cuboid formed by placing 3 cubes adjacently has the dimensions $3a$, a and a.
Surface area of the cuboid $= 2\ [3a \times a + a \times a + 3a \times a]$
$= 2\ (3a^2 + a^2 + 3a^2) = 14a^2$.
Sum of surface areas of 3 cubes $= (3 \times 6a^2) = 18a^2$.
$\therefore$ Required ratio $= 14a^2 : 18a^2 = 7 : 9$.

95. Let the sides of the three cubes be $3x$, $4x$ and $5x$.
Then, Volume of the new cube $= [(3x)^3 + (4x)^3 + (5x)^3] = 216x^3$.
Edge of the new cube $= (216x^3)^{1/3} = 6x$.
Diagonal of the new cube $= 6\sqrt{3}\,x$.
$\therefore\ 6\sqrt{3}\,x = 12\sqrt{3} \Rightarrow x = 2$.
So, the sides of the cubes are 6 cm, 8 cm and 10 cm.

96. Let their edges be a and b.
Then, $\frac{a^3}{b^3} = \frac{27}{1} \Leftrightarrow \left(\frac{a}{b}\right)^3 = \left(\frac{3}{1}\right)^3$
$\Leftrightarrow \frac{a}{b} = \frac{3}{1} \Leftrightarrow a : b = 3 : 1$.

97. Let their edges be a and b. Then,
$\frac{a^3}{b^3} = \frac{8}{27} \Leftrightarrow \left(\frac{a}{b}\right)^3 = \left(\frac{2}{3}\right)^3 \Leftrightarrow \frac{a}{b} = \frac{2}{3} \Leftrightarrow \frac{a^2}{b^2} = \frac{4}{9}$
$\Leftrightarrow \frac{6a^2}{6b^2} = \frac{4}{9}$.

98. Let their edges be a and b. Then,
$\frac{a^3}{b^3} = \frac{1}{27} \Leftrightarrow \left(\frac{a}{b}\right)^3 = \left(\frac{1}{3}\right)^3 \Leftrightarrow \frac{a}{b} = \frac{1}{3} \Leftrightarrow \frac{a^2}{b^2} = \frac{1}{9}$.

99. Let original edge $= a$. Then, volume $= a^3$.
New edge $= 2a$. So, new volume $= (2a)^3 = 8a^3$.
$\therefore$ Volume becomes 8 times.

100. Let original edge $= a$. Then, original volume $= a^3$.
New edge $= \frac{150}{100}a = \frac{3a}{2}$. New volume $= \left(\frac{3a}{2}\right)^3 = \frac{27a^3}{8}$.
Increase in volume $= \left(\frac{27a^3}{8} - a^3\right) = \frac{19a^3}{8}$.
$\therefore$ Increase% $= \left(\frac{19a^3}{8} \times \frac{1}{a^3} \times 100\right)\% = 237.5\%$.

101. Let original edge $= a$. The, surface area $= 6a^2$.
New edge $= \frac{125}{100}a = \frac{5a}{4}$.
New surface area $= 6 \times \left(\frac{5a}{4}\right)^2 = \frac{75a^2}{8}$.
Increase in surface area $= \left(\frac{75a^2}{8} - 6a^2\right) = \frac{27a^2}{8}$.
$\therefore$ Increase % $= \left(\frac{27a^2}{8} \times \frac{1}{6a^2} \times 100\right)\% = 56.25\%$.

102. Volume increased $= (20)^3$ cm^3 $= 8000$ cm^3.
$\therefore$ Rise in water level $= \left(\frac{8000}{20 \times 40}\right)$ cm $= 10$ cm.

103. Volume $= \pi r^2 h = \left(\frac{22}{7} \times 1 \times 1 \times 14\right)$ m^3 $= 44$ m^3.

104. Volume $= \pi r^2 h = \left(\frac{22}{7} \times 14 \times 14 \times 3.5\right)$ m^3 $= 2156$ m^3.
$\therefore$ Cost of the cylinder = ₹ (2156 × 50) = ₹ 107800.

105. Total surface area $= 2\pi r(h + r) = \left[2 \times \frac{22}{7} \times 21 \times (35 + 21)\right]$ cm^2
$= 7392$ cm^2.

106. Volume of the tank = 246.4 litres = 246400 cm^3.
Let the radius of the base be r cm. Then,
$\left(\frac{22}{7} \times r^2 \times 400\right) = 246400 \Leftrightarrow r^2 = \left(\frac{246400 \times 7}{22 \times 400}\right) = 196 \Leftrightarrow r = 14$.
$\therefore$ Diameter of the base $= 2r = 28$ cm.

107. Volume of the cylinder = Volume of the cube $= (11)^3$ cm^3 $= 1331$ cm^3.
Let the radius of the base be r cm. Then,
$\frac{22}{7} \times r^2 \times 14 = 1331 \Rightarrow r^2 = \frac{1331}{44} = \frac{121}{4} \Rightarrow r = \frac{11}{2} = 5.5$.

108. Volume of cylinder = 25.872 litres = (25.872 × 1000) cm^3 = 25872 cm^3.
Let the radius of the base of the cylinder be r cm. Then, height $= (3r)$ cm.
$\therefore\ \frac{22}{7} \times r^2 \times (3r) = 25872 \Rightarrow r^3 = \frac{25872 \times 7}{66} = 2744$
$\Rightarrow r = \sqrt[3]{2744} = 14$.
Hence, area of the base $= \pi r^2 = \left(\frac{22}{7} \times 14 \times 14\right)$ cm^2 $= 616$ cm^2.

109. Clearly, the cylinder formed by rolling the paper along its length has height 18 cm and circumference of base 30 cm *i.e.*,
$h = 18$ cm and $2\pi r = 30$ or $r = \frac{30}{2} \times \frac{7}{22} = \frac{105}{22}$.
$\therefore$ Volume $= \pi r^2 h = \left(\frac{22}{7} \times \frac{105}{22} \times \frac{105}{22} \times 18\right)$ cm^3 $= \frac{14175}{11}$ cm^3.
The cylinder formed by rolling the paper along its breadth has height 30 cm and circumference of base 18 cm *i.e.*
$h = 30$ cm and $2\pi r = 18$ or $r = \frac{18}{2} \times \frac{7}{22} = \frac{63}{22}$.
$\therefore$ Volume $= \pi r^2 h = \left(\frac{22}{7} \times \frac{63}{22} \times \frac{63}{22} \times 30\right)$ cm^3 $= \frac{8505}{11}$ cm^3.
Required ratio $= \frac{14175}{11} : \frac{8505}{11} = 5 : 3$.

110. Let the breadths of the rectangles A_1, A_2 and A_3 be b_1, b_2 and b_3 respectively. Since the rectangles have the same area and $a_1 < a_2 < a_3$, we have: $b_1 > b_2 > b_3$.
When the rectangles are folded to form cylinders, then their lengths a_1, a_2, a_3 determine the radii of the cylinders while their breadths b_1, b_2, b_3 form their heights.
Volume of cylinder $= \pi r^2 h$.
Clearly, the rectangle A_3 with length a_3 shall have maximum value of r^2 and hence C_3 has maximum volume.

111. $2\pi r = 66 \Rightarrow r = \left(66 \times \frac{1}{2} \times \frac{7}{22}\right) = \frac{21}{2}$ cm.
$\frac{2\pi rh}{2\pi r} = \left(\frac{2640}{66}\right) \Rightarrow h = 40$ cm.
$\therefore$ Volume $= \left(\frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 40\right)$ cm^3 $= 13860$ cm^3.

112. Curved surface area $= 2\pi rh = \left(2 \times \frac{22}{7} \times \frac{7}{2} \times 22.5\right)$ m^2
$= 495$ m^2.
$\therefore$ Cost of plastering = ₹ (495 × 3) = ₹ 1485.

113. Let the radius and height of the cylinder be $5x$ and $7x$ cm respectively.
Then, volume $= \pi r^2 h = \left[\frac{22}{7} \times (5x)^2 \times 7x\right]$ cm^3

$= (550\,x^3)$ cm^3.

$\therefore$ $550\,x^3 = 4400 \Rightarrow x^3 = \dfrac{4400}{550} = 8 \Rightarrow x = \sqrt[3]{8} = 2.$

Hence, radius = (5 × 2) cm = 10 cm.

114. $\dfrac{2\pi rh}{h} = \dfrac{704}{14} \Rightarrow 2\pi r = \dfrac{704}{14}. \Rightarrow r = \left(\dfrac{704}{14}\times\dfrac{1}{2}\times\dfrac{7}{22}\right) = 8$ cm.

$\therefore$ Volume $= \left(\dfrac{22}{7}\times 8\times 8\times 14\right)\text{cm}^3 = 2816\text{ cm}^3.$

115. Total surface area

$= 2\pi r\,(h+r) = \left[2\times\dfrac{22}{7}\times\dfrac{35}{100}\times(1.25+0.35)\right]\text{m}^2$

$= \left(2\times\dfrac{22}{7}\times\dfrac{35}{100}\times\dfrac{16}{10}\right)\text{m}^2 = 3.52\text{ m}^2.$

$\therefore$ Cost of the material = ₹ (3.52 × 80) = ₹ 281.60.

116. Curved surface area $= 2\pi rh = (\pi r^2h)\cdot\dfrac{2}{r} = \left(\text{Volume}\times\dfrac{2}{r}\right).$

117. $\dfrac{\text{Total surface area}}{\text{Lateral surface area}} = \dfrac{2\pi rh + 2\pi r^2}{2\pi rh} = \dfrac{(h+r)}{h} = \dfrac{80}{60} = \dfrac{4}{3}.$

118. Difference in capacities = Volume of cuboidal can – Volume of cylindrical can

$= \left[(10\times 10\times 21) - \left(\dfrac{22}{7}\times 5\times 5\times 21\right)\right]\text{cm}^3$

$= (2100 - 1650)$ cm^3 = 450 cm^3.

119. Number of tins $= \dfrac{\text{Volume of the drum}}{\text{Volume of each tin}}$

$= \dfrac{\left(\dfrac{22}{7}\times\dfrac{35}{2}\times\dfrac{35}{2}\times 24\right)}{\left(\dfrac{25}{10}\times\dfrac{22}{10}\times\dfrac{35}{10}\right)} = 1200.$

120. It is given that $r = \dfrac{1}{2}h$ and $2\pi rh + \pi r^2 = 616\text{ m}^2$

$\therefore$ $2\pi\times\dfrac{1}{2}h\times h + \pi\times\dfrac{1}{4}h^2 = 616$

$\Rightarrow \dfrac{5}{4}\times\dfrac{22}{7}\times h^2 = 616 \Rightarrow h^2 = \left(616\times\dfrac{28}{110}\right) = \dfrac{28\times 28}{5}.$

$\therefore$ Volume

$= \pi r^2 h = \dfrac{22}{7}\times\dfrac{1}{4}h^2\times h = \dfrac{22}{7}\times\dfrac{1}{4}\times\dfrac{28\times 28}{5}\times\dfrac{28}{\sqrt{5}}\text{ cm}^3$

$= \left(\dfrac{22\times 28\times 28}{25}\times\sqrt{5}\right)\text{cm}^3 = \left(\dfrac{22\times 28\times 28\times 2.23}{25\times 1000}\right)\text{litres}$

= 1.53 litres.

121. $(h + r) = 37$ and $2\pi r\,(h + r) = 1628$. $\therefore$ $2\pi r\times 37 = 1628$

or $r = \left(\dfrac{1628}{2\times 37}\times\dfrac{7}{22}\right) = 7.$

So, $r = 7$ m and $h = 30$ m.

$\therefore$ Volume $= \left(\dfrac{22}{7}\times 7\times 7\times 30\right)\text{m}^3 = 4620\text{ m}^3.$

122. $\dfrac{\pi r^2h}{2\pi rh} = \dfrac{924}{264} \Rightarrow r = \left(\dfrac{924}{264}\times 2\right) = 7$ m. And, $2\pi rh = 264$

$\Rightarrow h = \left(264\times\dfrac{7}{22}\times\dfrac{1}{2}\times\dfrac{1}{7}\right) = 6$ m.

$\therefore$ Required ratio $= \dfrac{2r}{h} = \dfrac{14}{6} = 7:3.$

123. $3\times 2\pi r^2 = 2\times 2\pi rh \Rightarrow 6r = 4h \Rightarrow r = \dfrac{2}{3}h = \left(\dfrac{2}{3}\times 6\right)\text{m} = 4\text{m}.$

124. $V = \pi r^2h$ and $S = 2\pi rh + 2\pi r^2 \Rightarrow S = 2\pi r\,(h + r),$

where $h = \dfrac{V}{\pi r^2} \Rightarrow S = 2\pi r\left(\dfrac{V}{\pi r^2} + r\right) = \dfrac{2V}{r} + 2\pi r^2$

$\Rightarrow \dfrac{dS}{dr} = \dfrac{-2V}{r^2} + 4\pi r$ and $\dfrac{d^2S}{dr^2} = \left(\dfrac{4V}{r^3} + 4\pi\right) > 0$

$\therefore$ S is minimum when $\dfrac{dS}{dr} = 0 \Leftrightarrow \dfrac{-2V}{r^2} + 4\pi r = 0 \Leftrightarrow V$

$= 2\pi r^3 \Leftrightarrow \pi r^2h = 2\pi r^3 \Leftrightarrow h = 2r.$

125. Let original radius = R. Then, new radius $= \dfrac{R}{2}.$

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

126. Let their radii be $3x$, $4x$ and heights be $4y$, $3y$.

Ratio of their volumes $= \dfrac{\pi\times(3x)^2\times 4y}{\pi\times(4x)^2\times 3y} = \dfrac{36}{48} = \dfrac{3}{4}.$

127. Let original height = h and original radius = r.

New height = 115% of $h = \dfrac{23h}{20}.$

New radius = 90% of $r = \dfrac{9r}{10}.$

Original curved surface area = $2\pi rh$.

New curved surface area $= \left(2\pi\times\dfrac{9r}{10}\times\dfrac{23h}{20}\right) = \dfrac{207}{200}\times 2\pi rh.$

Increase in curved surface area =

$\left(\dfrac{207}{200}\times 2\pi rh - 2\pi rh\right) = \dfrac{7}{200}\times 2\pi rh.$

$\therefore$ Increase% $= \left(\dfrac{7}{200}\times 2\pi rh\times\dfrac{1}{2\pi rh}\times 100\right)\% = 3.5\%.$

128. Let their heights be $2h$ and $3h$ and radii be r and R respectively. Then,

$\pi r^2(2h) = \pi R^2(3h) \Rightarrow \dfrac{r^2}{R^2} = \dfrac{3}{2} \Rightarrow \dfrac{r}{R} = \dfrac{\sqrt{3}}{\sqrt{2}}$ i.e. $\sqrt{3}:\sqrt{2}.$

129. Let the height of X and Y be h, and their radii be r and $2r$ respectively. Then,

Volume of $X = \pi r^2h$ and Volume of $Y = \pi\,(2r)^2\,h = 4\pi r^2h$.

New height of $X = 2h$.

So, new volume of X

$= \pi r^2\,(2h) = 2\pi r^2h = \dfrac{1}{2}(4\pi r^2h) = \dfrac{1}{2}\times(\text{Volume of }Y).$

130. Let original radius = r and original length = h.

New radius $= \dfrac{r}{3}$ and let new length = H. Then,

$\pi r^2h = \pi\left(\dfrac{r}{3}\right)^2\times H$ or $H = 9H$.

131. Let original radius = r and original height = h. Original volume = πr^2h.

New radius = 50% of $r = \frac{r}{2}$.

New height = 150% of $h = \frac{3h}{2}$.

New volume = $\pi\left(\frac{r}{2}\right)^2\left(\frac{3h}{2}\right) = \pi \times \frac{r^2}{4} \times \frac{3h}{2} = \frac{3}{8}\pi r^2 h.$

Decrease in volume $= \pi r^2 h - \frac{3}{8}\pi r^2 h = \frac{5}{8}\pi r^2 h.$

$\therefore$ Decrease% $= \left(\frac{5}{8}\pi r^2 h \times \frac{1}{\pi r^2 h} \times 100\right)\% = 62.5\%.$

132. Let original radius = r and original height = h.
Original volume = $\pi r^2 h$.

New radius = 125% of $r = \frac{5r}{4}$. Let new height = H.

Then, $\pi r^2 h = \pi\left(\frac{5r}{4}\right)^2 \times H$ or $H = \frac{16}{25}h.$

Decrease in height = $\left(h - \frac{16}{25}h\right) = \frac{9h}{25}.$

$\therefore$ Decrease% = $\left(\frac{9h}{25} \times \frac{1}{h} \times 100\right)\% = 36\%.$

133. Let the drop in the water level be h cm. Then,

$\frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} \times h = 11000 \;\Leftrightarrow\; h = \left(\frac{11000 \times 7 \times 4}{22 \times 35 \times 35}\right)$ cm

$= \frac{80}{7}$ cm $= 11\frac{3}{7}$ cm.

134. Volume of earth dug out = $\left(\frac{22}{7} \times 4 \times 4 \times 14\right)$ m^3 = 704 m^3.

Area of embankment

$= \frac{22}{7} \times (7^2 - 4^2) = \left(\frac{22}{7} \times 11 \times 3\right)$ m^2 $= \frac{726}{7}$ m^3.

Height of embankment =

$\left(\frac{\text{Volume}}{\text{Area}}\right) = \left(\frac{704 \times 7}{726}\right)$ m $= \frac{224}{33}$ m $= 6\frac{26}{33}$ m.

135. Volume of water flown in 1 sec.

$= \left(\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 200\right)$ cm^3 = 7700 cm^3.

Volume of water flown in 10 min.= (7700 × 60 × 10) cm^3

$= \left(\frac{7700 \times 60 \times 10}{1000}\right)$ litres = 4620 litres.

136. Volume of cistern = (π × 10^2 × 15) m^3 = 1500 π m^3.
Volume of water flowing through the pipe in 1 sec.
= (π × 0.25 × 0.25 × 5) m^3 = 0.3125 π m^3.

$\therefore$ Time taken to fill the cistern $= \left(\frac{1500\pi}{0.3125\pi}\right) = \left(\frac{1500 \times 10000}{3125}\right)$

$= 4800$ sec $= \left(\frac{4800}{60}\right)$ min = 80 min.

137. Let the inner radius of the pipe be r metres. Then,

Volume of water flowing through the pipe in 10 min

$= \left[\left(\frac{22}{7} \times r^2 \times 7\right) \times 10\right]$ m^3 = $(220r^2)$m^3.

$\therefore$ 220 r^2 = 440 $\Rightarrow r^2 = 2 \Rightarrow r = \sqrt{2}$ m.

138. Volume of water flown through the pipe in 30 min
= [(π × 0.01 × 0.01 × 6) × 30 × 60] m^3 = (1.08 π) m^3.
Let the rise in level of water be h metres.

Then, π × 0.6 × 0.6 × h = 1.08 $\pi \Rightarrow h = \left(\frac{1.08}{0.6 \times 0.6}\right) = 3$ m.

139. Volume of water flown into the tank in 5 min.

$= \left(\frac{22}{7} \times 100 \times 100 \times 7\right)$ cu. feet = 2220000 cu. feet.

$\therefore$ Rate of flow of water = $\left(\frac{220000}{5 \times 60}\right)$ cu. ft/sec = 733.3 cu. ft/sec ≈ 700 cu. ft/sec.

140. Let the length of each pipe be l inches.
Then, volume of water in thinner pipe

$= \left[\pi \times \left(\frac{1}{2}\right)^2 \times l\right]$ cu. inch $= \left(\frac{\pi l}{4}\right)$ cu. inch.

Volume of water in thicker pipe = (π × 3^2 × l) cu.inch
= (9πl) cu.inch.

$\therefore$ Required number of pipes = $\frac{9\pi l}{\left(\frac{\pi l}{4}\right)} = 36.$

141. Volume of one coin $= \left(\frac{22}{7} \times \frac{75}{100} \times \frac{75}{100} \times \frac{2}{10}\right)$ cm^3 $= \frac{99}{280}$ cm^3.

Volume of larger cylinder = $\left(\frac{22}{7} \times \frac{9}{4} \times \frac{9}{4} \times 10\right)$ cm^3.

Number of coins = $\left(\frac{22}{7} \times \frac{9}{4} \times \frac{9}{4} \times 10 \times \frac{280}{99}\right) = 450.$

142. Let the radius of the vessel be R. Then,
πR^2 × 15 = π × (15)^2 × 35 + π × (10)^2 × 15 ⇔ πR^2 × 15 = 9375π ⇔ R^2 = 625 ⇔ R = 25 cm.

143. Let the length of the wire be h. Radius $= \frac{1}{2}$ mm $= \frac{1}{20}$ cm. Then,

$\frac{22}{7} \times \frac{1}{20} \times \frac{1}{20} \times h = 66 \;\Leftrightarrow\; h = \left(\frac{66 \times 20 \times 20 \times 7}{22}\right) = 8400$ cm = 84 m.

144. Volume of copper rod = $\left(\pi \times \frac{1}{2} \times \frac{1}{2} \times 8\right)$ cm^3 = 2π cm^3.
Let the radius of the wire be r cm.
Then, volume of wire = (πr^2 × 1800) cm^3 = 1800 πr^2 cm^3.

$\therefore$ 1800 πr^2 = 2$\pi \Rightarrow r^2 = \frac{2}{1800} = \frac{1}{900} \Rightarrow r = \sqrt{\frac{1}{900}} = \frac{1}{30}.$

145. Curved surface area of the roller

$= \left(2 \times \frac{22}{7} \times 0.7 \times 2\right)$ m^2 = 8.8 m^2.

$\therefore$ Area covered in 5 revolutions = (8.8 × 5) m^2 = 44 m^2.

146. Diagonal of the square = $\sqrt{2^2 + 2^2}$ m $= \sqrt{8}$ m $= 2\sqrt{2}$ m.

Diameter of circular pond = $2\sqrt{2}$ m. Radius of circular pond = $\sqrt{2}$ m.

Volume of circular pond = $\left[\pi \times (\sqrt{2})^2 \times 1\right]$ m^3 = (2π) m^3.
Volume of square pond = (2 × 2 × 1) m^3 = 4 m^3.
$\therefore$ Volume of earth to be removed = $(2\pi - 4)$ m^3.

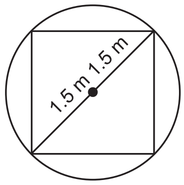
147. Volume of earth dug = $\left(\frac{22}{7} \times 2 \times 2 \times 56\right)$ m^3 = 704 m^3.

Volume of ditch = (48 × 16.5 × 4) m^3 = 3168 m^3.

$\therefore$ Required fraction = $\frac{704}{3168} = \frac{2}{9}.$

148. Volume of water flown into the tank
$= (50 \times 44 \times 0.07)\ m^3 = 154\ m^3$.
Volume of water flowing through the pipe in 1 hour
$= \left(\frac{22}{7} \times 0.07 \times 0.07 \times 5000\right) m^3 = 77 m^3$.
$\therefore$ Required time $= \left(\frac{154}{77}\right) = 2$ hrs.

149. Let the length of each side of the square base be x metres.
Then, $x^2 + x^2 = 32 \Rightarrow 2x^2 = 9$
$\Rightarrow x^2 = \frac{9}{2} \Rightarrow x = \frac{3}{\sqrt{2}}$.



$\therefore$ Volume of parallelopiped
$= \left(\frac{3}{\sqrt{2}} \times \frac{3}{\sqrt{2}} \times 10\right) m^3 = \frac{90}{2} m^3 = 45\ m^3$.

150. Volume of rain water $= (600 \times 400 \times 1)\ cm^3 = 240000\ cm^3$.
Let the height of water in the cylindrical vessel be h cm.
Then, $\frac{22}{7} \times 20 \times 20 \times h = 240000 \Rightarrow h = \frac{240000 \times 7}{22 \times 20 \times 20} = \frac{2100}{11}$
$= 190.9$ cm ≈ 191 cm.

151. External radius, $R = \frac{25}{2}$ cm.
Internal radius, $r = \left(\frac{25}{2} - 1\right) cm = \frac{23}{2}$ cm.
Length, $h = 20$ cm.
Whole surface area $= 2\pi Rh + 2\pi rh + 2\pi (R^2 - r^2) = 2\pi [(R + r)\ h + (R^2 - r^2)]$
$= 2 \times \frac{22}{7} \times \left[\left(\frac{25}{2} + \frac{23}{2}\right) \times 20 + \left(\frac{25}{2} + \frac{23}{2}\right)\left(\frac{25}{2} - \frac{23}{2}\right)\right]$
$= \left(2 \times \frac{22}{7} \times 504\right) cm^2 = 3168\ cm^2$.

152. Circumference of the girth = 440 cm.
$\therefore 2\pi R = 440 \Rightarrow R = \left(440 \times \frac{1}{2} \times \frac{7}{22}\right) = 70$ cm.
So, Outer radius = 70 cm.
Inner radius = (70 – 4) cm = 66 cm.
Volume of iron $= \pi\ [(70)^2 - (66)^2] \times 63$
$= \left(\frac{22}{7} \times 136 \times 4 \times 63\right) cm^3 = 58752\ cm^3$.

153. Internal radius $= \left(\frac{11.2}{2}\right) cm = 5.6$ cm,
External radius = (5.6 + 0.4) cm = 6 cm.
Volume of metal
$= \left\{\frac{22}{7} \times [(6)^2 - (5.6)^2] \times 21\right\} cm^3 = (66 \times 11.6 \times 0.4)\ cm^3$
$= 306.24\ cm^3$.

154. External radius = 6 cm,
Internal radius = (6 – 0.25) cm
= 5.75 cm.
Volume of material in hollow cylinder
$= \left\{\frac{22}{7} \times [(6)^2 - (5.75)^2] \times 15\right\} cm^3$
$= \left(\frac{22}{7} \times 11.75 \times 0.25 \times 15\right) cm^3$
$= \left(\frac{22}{7} \times \frac{1175}{100} \times \frac{25}{100} \times 15\right) cm^3 = \left(\frac{11 \times 705}{56}\right) cm^3$.
Let the length of solid cylinder be h. Then,
$\frac{22}{7} \times 1 \times 1 \times h = \left(\frac{11 \times 705}{56}\right) \Leftrightarrow h = \left(\frac{11 \times 705}{56} \times \frac{7}{22}\right)$cm
= 44.0625 cm.

155. External radius = 4 cm, Internal radius = 3 cm.
Volume of iron
$= \left\{\frac{22}{7} \times [(4)^2 - (3)^2] \times 21\right\} cm^3 = \left(\frac{22}{7} \times 7 \times 1 \times 21\right) cm^3$
$= 462\ cm^3$.
$\therefore$ Weight of iron = (462 × 8) gm = 3696 gm = 3.696 kg.

156. Let the outer radius of the pipe be R cm.
Then, volume of metal used = External volume – Internal volume $= \pi R^2 h - \pi r^2 h = \pi h\ (R^2 - r^2)$
$= \frac{22}{7} \times 28 \times (R^2 - 8^2) = 88\ (R^2 - 64)$.
$\Rightarrow 88\ (R^2 - 64) = 1496 \Rightarrow R^2 - 64 = 17 \Rightarrow R^2 = 81$
$\Rightarrow R = 9$ cm.

157. Let the capacity of the cylindrical vessel be x litres.
Then, capacity of the cuboidal vessel $= (x + 20)$ litres.
$\therefore (x + 20) - 30 = 2(x - 30) \Rightarrow x - 10 = 2x - 60 \Rightarrow x = 50$.

158. Let the internal radius of the cylinder be x. Then,
$\frac{22}{7} \times r^2 \times 40 = \frac{616}{10} \Leftrightarrow r^2 = \left(\frac{616 \times 7}{10 \times 22 \times 40}\right) = 0.49$
$\Leftrightarrow r = 0.7$.
So, internal radius = 0.7 cm = 7 mm.
$\therefore$ Thickness = (8 – 7) mm = 1 mm.

160. $\frac{\text{Volume of cone}}{\text{Volume of cylinder}} = \frac{\frac{1}{3} \times \pi \times (3)^2 \times 5}{\pi \times (2)^2 \times 4} = \frac{45}{48} = \frac{15}{16}$.

161. Volume of water $= \left(\frac{1}{3} \times \frac{22}{7} \times 8 \times 8 \times 21\right) cm^3 = 1408\ cm^3$
$= \left(\frac{1408}{1000}\right) kg = 1.408$ kg.

162. Radius, $r = 2$ cm. Height, $h = 4.8$ cm.
$\therefore$ Slant height, $l = \sqrt{r^2 + h^2} = \sqrt{2^2 + (4.8)^2}$ cm
$= \sqrt{4 + 23.04}$ cm $= \sqrt{27.04}$ cm = 5.2 cm.

163. $h = 84$ cm, $r = 35$ cm.
So, $l = \sqrt{r^2 + h^2} = \sqrt{(35)^2 + (84)^2} = \sqrt{8281}$ cm = 91 cm.
$\therefore$ Curved surface area
$= \pi rl = \left(\frac{22}{7} \times 35 \times 91\right) cm^2 = 10010\ cm^2$.

164. $h = 15$ cm, $r = 8$ cm. So, $l = \sqrt{r^2 + h^2} = \sqrt{8^2 + (15)^2} = 17$ cm.
$\therefore$ Curved surface area $= \pi rl = (\pi \times 8 \times 17)\ cm^2$
$= 136\pi\ cm^2$.

165. $h = 14$ cm, $r = 7$ cm. So, $l = \sqrt{(7)^2 + (14)^2} = \sqrt{245} = 7\sqrt{5}$ cm.
$\therefore$ Total surface area $= \pi rl + \pi r^2$
$= \left(\frac{22}{7} \times 7 \times 7\sqrt{5} + \frac{22}{7} \times 7 \times 7\right) cm^2$

$= [154(\sqrt{5}+1)]\text{ cm}^2 = (154 \times 3.236)\text{ cm}^2 = 498.35\text{ cm}^2.$

166. Clearly, we have $r = 3$ cm and $h = 4$ cm.

$\therefore$ Volume $= \frac{1}{3}\pi r^2 h = \left(\frac{1}{3} \times \pi \times 3^2 \times 4\right)\text{cm}^3 = 12\pi\text{ cm}^3.$

167. $l = 10$ m, $h = 8$ m. So, $r = \sqrt{l^2 - h^2} = \sqrt{(10)^2 - 8^2} = 6$ m.

$\therefore$ Curved surface area $= \pi rl = (\pi \times 6 \times 10)\text{ m}^2 = 60\pi\text{ m}^2.$

168. $\frac{1}{3} \times \frac{22}{7} \times r^2 \times 24 = 1232 \Leftrightarrow r^2 = \left(\frac{1232 \times 7 \times 3}{22 \times 24}\right) = 49$

$\Leftrightarrow r = 7.$

Now, $r = 7$ cm, $h = 24$ cm. So, $l = \sqrt{(7)^2 + (24)^2} = 25$ cm.

$\therefore$ Curved surface area $= \left(\frac{22}{7} \times 7 \times 25\right)\text{cm}^2 = 550\text{ cm}^2.$

169. Let radius of base $= r$ and height $= h$.
Required floor area $= (4 \times 11)\text{ m}^2 = 44\text{ m}^2$. So, $\pi r^2 = 44$.
Required volume $= (20 \times 11)\text{ m}^3 = 220\text{ m}^3$.

So, $\frac{1}{3}\pi r^2 h = 220 \Rightarrow \frac{1}{3} \times 44 \times h = 220 \Rightarrow h = \frac{220 \times 3}{44} = 15$ m.

170. Let the radius of base be r ft. Then, $2\pi r = 10\pi$ or $r = 5$.

$l = \sqrt{r^2 + h^2} = \sqrt{5^2 + (12)^2} = \sqrt{169} = 13$ ft.

$\therefore$ Area of cloth $= \pi rl = (\pi \times 5 \times 13)$ sq ft $= 65\pi$ sq ft.

171. Let the radius of the base be r km. Then,

$\pi r^2 = 1.54 \Rightarrow r^2 = \left(\frac{1.54 \times 7}{22}\right) = 0.49 \Rightarrow r = 0.7$ km.

Now, $l = 2.5$ km, $r = 0.7$ km.

$\therefore h = \sqrt{(2.5)^2 - (0.7)^2}\text{ km} = \sqrt{6.25 - 0.49}\text{ km} = \sqrt{5.76}\text{ km}$

$= 2.4$ km.

So, height of the mountain $= 2.4$ km.

172. $\pi r^2 = 3850 \Rightarrow r^2 = \left(\frac{3850 \times 7}{22}\right) = 1225 \Rightarrow r = 35.$

Now, $r = 35$ cm, $h = 84$ cm.

So, $l = \sqrt{(35)^2 + (84)^2} = \sqrt{1225 + 7056} = \sqrt{8281} = 91$ cm.

$\therefore$ Curved surface area $= \left(\frac{22}{7} \times 35 \times 91\right)\text{cm}^2 = 10010\text{ cm}^2.$

173. $\frac{22}{7} \times 70 \times l = 40040 \Rightarrow l = \left(\frac{40040 \times 7}{22 \times 70}\right) = 182.$

Now, $l = 182$ cm, $r = 70$ cm.

So, $h = \sqrt{(182)^2 - (70)^2} = \sqrt{252 \times 112} = 168$ cm.

$\therefore$ Volume $= \left(\frac{1}{3} \times \frac{22}{7} \times 70 \times 70 \times 168\right)\text{cm}^3 = 862400\text{ cm}^3.$

174. Let the radius and height of the cone be $3x$ and $4x$ respectively. Then,

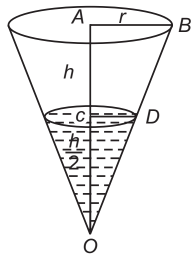
$\frac{1}{3} \times \frac{22}{7} \times (3x)^2 \times 4x = \frac{2112}{7} \Leftrightarrow \frac{264}{7}x^3 = \frac{2112}{7} \Leftrightarrow x^3 = \frac{2112}{64} = 8$

$\Leftrightarrow x = 2.$

$\therefore$ Radius $= 6$ cm, Height $= 8$ cm. Slant height

$= \sqrt{6^2 + 8^2}\text{ cm} = \sqrt{100}\text{ cm} = 10$ cm.

175. Let the radius and height of the cone be r and h respectively.



Then, $V = \frac{1}{3}\pi r^2 h.$

Now, $\Delta AOB \sim \Delta COD$.

So, $\frac{OA}{OC} = \frac{AB}{CD} \Rightarrow \frac{h}{h/2} = \frac{r}{CD} \Rightarrow CD = \frac{r}{2}.$

$\therefore$ Volume of water $= \frac{1}{3}\pi\left(\frac{r}{2}\right)^2\left(\frac{h}{2}\right) = \frac{1}{8}\left(\frac{1}{3}\pi r^2 h\right) = \frac{V}{8}.$

176. Slant height of the cup, l = Radius of sheet = 14 cm.

Circumference of the base = Circumference of the paper sheet $= \left(\frac{22}{7} \times 14\right)\text{cm} = 44$ cm.

Let the radius of the base of the cone be r cm.

$\therefore 2\pi r = 44 \Rightarrow r = \frac{44 \times 7}{2 \times 22} = 7.$

Height, $h =$

$\sqrt{l^2 - r^2} = \sqrt{(14)^2 - 7^2} = \sqrt{147} = 7\sqrt{3}\text{ cm} = 12.12$ cm.

177. $\pi r^2 = 346.5 \Rightarrow r^2 = \left(346.5 \times \frac{7}{22}\right) = \frac{441}{4} \Rightarrow r = \frac{21}{2}.$

$\therefore l = \sqrt{r^2 + h^2} = \sqrt{\frac{441}{4} + (14)^2} = \sqrt{\frac{1225}{4}} = \frac{35}{2}.$

So, area of canvas needed =

$\pi rl = \left(\frac{22}{7} \times \frac{21}{2} \times \frac{35}{2}\right)\text{m}^2 = \left(\frac{33 \times 35}{2}\right)\text{m}^2.$

$\therefore$ Length of canvas $= \left(\frac{33 \times 35}{2 \times 1.1}\right)\text{m} = 525$ m.

178. Let the original radius and height of the cone be r and h respectively.
Then, new radius $= 3r$ and new height $= 2h$.

$\therefore \frac{\text{New volume}}{\text{Original volume}} = \frac{\frac{1}{3} \times \pi \times (3r)^2 \times 3h}{\frac{1}{3} \times \pi \times r^2 \times h} = \frac{18}{1}.$

179. Let the original radius and height of the cone be r and h respectively.

Then, Original volume $= \frac{1}{3}\pi r^2 h.$

New radius $= \frac{120}{100}r = \frac{6}{5}r$, New height $= \frac{6}{5}h.$

New volume $= \frac{1}{3}\pi \times \left(\frac{6}{5}r\right)^2 \times \left(\frac{6}{5}h\right) = \frac{216}{125} \times \frac{1}{3}\pi r^2 h.$

Increase in volume $= \frac{91}{125} \times \frac{1}{3}\pi r^2 h.$

$\therefore$ Increase % $= \left(\frac{\frac{91}{125} \times \frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi r^2 h} \times 100\right)\% = 72.8\%.$

180. Let the original radius and height of the cone be r and h respectively.

Then, original volume $= \frac{1}{3}\pi r^2 h.$

New radius $= \frac{r}{2}$ and new height $= 3h$.

New volume $= \frac{1}{3}\times\pi\times\left(\frac{r}{2}\right)^2\times 3h = \frac{3}{4}\times\frac{1}{3}\pi r^2 h$.

$\therefore$ Decrease % $= \left(\frac{\frac{1}{4}\times\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi r^2 h}\times 100\right)\% = 25\%$.

181. Required ratio $= \frac{\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi r^2\times(2h)} = \frac{1}{2}$.

182. Volume of the cone, $v = \frac{1}{3}\pi r^2 h$.

Curved surface area, $c = \pi r l = \pi r\sqrt{r^2+h^2}$

$\Rightarrow c^2 = \pi^2 r^2(r^2+h^2)$.

$\therefore 3\pi v h^3 - c^2h^2 + 9v^2$

$= 3\pi\times\frac{1}{3}\pi r^2 h\times h^3 - \pi^2 r^2(r^2+h^2)h^2 + 9\times\frac{1}{9}\pi^2 r^4 h^2$

$= \pi^2 r^2 h^4 - \pi^2 r^4 h^2 - \pi^2 r^2 h^4 + \pi^2 r^4 h^2 = 0$.

183. Let the heights of two cones be $7x$ and $3x$ and their radii be $6y$ and $7y$ respectively. Then,

Ratio of volumes $= \frac{\frac{1}{3}\pi\times(6y)^2\times 7x}{\frac{1}{3}\pi\times(7y)^2\times 3x} = \frac{36\times 7}{49\times 3} = \frac{12}{7}$.

184. Let their radii be $2x$, x and their heights be h and H respectively. Then,

$\frac{1}{3}\times\pi\times(2x)^2\times h = \frac{1}{3}\times\pi\times x^2\times H$ or $\frac{h}{H} = \frac{1}{4}$.

185. Let their radii be x and $2x$, and their heights be h and H respectively. Then,

$\frac{\frac{1}{3}\times\pi\times x^2\times h}{\frac{1}{3}\times\pi\times(2x)^2\times H} = \frac{2}{3}$ or $\frac{h}{H} = \frac{2}{3}\times 4 = \frac{8}{3}$.

186. Volume of the largest cone

= Volume of the cone with diameter of base 9 cm and height 9 cm.

$= \left(\frac{1}{3}\times\frac{22}{7}\times 4.5\times 4.5\times 9\right)\text{cm}^3\left(\frac{1336.5}{7}\right)\text{cm}^3 = 190.93\text{ cm}^3$

187. Volume of the block $= (10\times 5\times 2)$ cm^3 = 100 cm^3.

Volume of the cone carved out =

$\left(\frac{1}{3}\times\frac{22}{7}\times 3\times 3\times 7\right)\text{cm}^3 = 66\text{ cm}^3$.

$\therefore$ Wood wasted $= (100 - 66)\% = 34\%$.

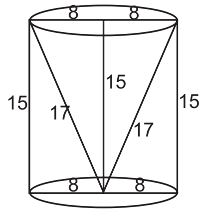
188. Let their radius and height be $5x$ and $12x$ respectively.

Slant height of the cone, $l = \sqrt{(5x)^2+(12x)^2} = 13x$.

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

$= \frac{2\times(12x+5x)}{(13x+5x)} = \frac{34x}{18x} = \frac{17}{9}$.

189. Total surface area of the remaining solid = Curved surface area of the cylinder



+ Area of the base of the cylinder

+ Curved surface area of the cone

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

$= 2\pi\times 8\times 15 + \pi\times 8^2 + \pi\times 8\times\sqrt{8^2+(15)^2}$

$= 240\pi + 64\pi + 136\pi = 440\pi$ sq. cm.

190. Let the height of the cone be h cm.

Then, $\pi\times r^2\times 6 = \frac{1}{3}\times\pi\times r^2\times h \Rightarrow h = 18$ cm.

191. Let the radius of the cone be r cm.

Then, $\pi\times 8^2\times 2 = \frac{1}{3}\times\pi\times r^2\times 6 \Rightarrow r = 8$.

Slant height, $l = \sqrt{r^2+h^2} = \sqrt{8^2+6^2} = \sqrt{100}\text{ cm} = 10\text{ cm}$.

Curved surface area of cone $= \pi rl = (3.14\times 8\times 10)$ cm^2

= 251.2 cm^2

192. Let radius of each be r and height of each be h.

Then, number of cones needed

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

193. Volume of cylinder $= (\pi\times 3\times 3\times 5)$ cm^3 $= 45\pi$ cm^3.

Volume of 1 cone $= \left(\frac{1}{3}\pi\times\frac{1}{10}\times\frac{1}{10}\times 1\right)\text{cm}^3 = \frac{\pi}{300}\text{ cm}^3$.

$\therefore$ Number of cones $= \left(45\pi\times\frac{300}{\pi}\right) = 13500$.

194. Volume of cylinder $= \left(\pi\times\frac{35}{2}\times\frac{35}{2}\times 32\right)\text{cm}^3 = 9800\,\pi\,\text{cm}^3$.

Volume of 1 cone $= \left(\frac{1}{3}\times\pi\times 2\times 2\times 7\right)\text{cm}^3 = \frac{28\pi}{3}\text{ cm}^3$.

$\therefore$ Number of persons that can be served

$= \left(9800\pi\times\frac{3}{28\pi}\right) = 1050$.

195. Let the radius and height of the cone and the cylinder be $4x$ and $3x$ respectively.

Then, total surface area of cylinder

$= [2\pi\ (4x)\ (4x + 3x)]$ sq. units $= (8\pi\ x.\ 7x)$ sq. units.

$= (56\ \pi\ x^2)$ sq. units.

Slant height of cone, $l = \sqrt{(4x)^2+(3x)^2} = \sqrt{25x^2} = 5x$.

Total surface area of cone $= \pi r(l + r) = \pi.4x\ (5x + 4x)$

$= (36\pi\ x^2)$ sq. units

$\therefore$ Required ratio $= \frac{56\pi\,x^2}{36\pi\,x^2} = 14:9$.

196. Volume flown in conical vessel $= \frac{1}{3}\pi\times(20)^2\times 24 = 3200\pi$.

Volume flown in 1 min. $= \left(\pi\times\frac{2.5}{10}\times\frac{2.5}{10}\times 1000\right) = 62.5\pi$.

$\therefore$ Time taken $= \left(\frac{3200\pi}{62.5\pi}\right) = 51\text{ min. }12\text{ sec.}$

197. Volume of milk in conical flask = $\left(\frac{1}{3}\pi a^2 h\right)\text{cm}^3$.

Let the height of the milk in the cylindrical flask be x cm. Then, volume of milk in cylindrical flask = $(\pi p^2 x)$ cm^3.

$\therefore\ \frac{1}{3}\pi a^2 h = \pi p^2 x \Rightarrow x = \frac{1}{3}\frac{\pi a^2 h}{\pi p^2} = \frac{a^2 h}{3p^2}$ cm.

198. Slant height of the cone, $l = \sqrt{(12)^2 + (5)^2} = 13$ cm.

Lateral surface of the solid = Curved surface of cone + Curved surface of cylinder + Surface area of bottom

$= \pi rl + 2\pi rh + \pi r^2$, where h is the height of the cylinder

$= \pi r\,(l + h + r) = \left[\frac{22}{7}\times 12\times(13 + 18 + 12)\right]\text{cm}^2$

$= \left(\frac{22}{7}\times 12\times 43\right)\text{cm}^2 = \left(\frac{11352}{7}\right)\text{cm}^2 = 1621\frac{5}{7}\,\text{cm}^2$.

199. Radius, r = 12 m.

Height of conical part, h = (16 – 11) m = 5 m.

Slant height of conical part,

$l = \sqrt{r^2 + h^2} = \sqrt{(12)^2 + 5^2} = \sqrt{169} = 13$ m.

Height of cylindrical part, H = 11 m.

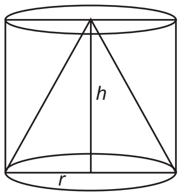
Area of canvas required = Curved surface area of cylinder + Curved surface area of cone

$= 2\pi rH + \pi rl$

$= \left[\frac{22}{7}(2\times 12\times 11 + 12\times 13)\right]\text{m}^2$

$= \left[\frac{22}{7}(264 + 156)\right]\text{m}^2 = \left(\frac{22}{7}\times 420\right)\text{m}^2 = 1320\ \text{m}^2$.

200. Let the radius and height of the tank be r and h respectively.



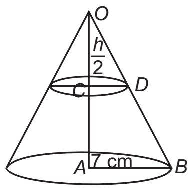
Then, $V = \pi r^2 h$.

$\therefore$ Volume of water in the tank = Vol. of cylinder – Vol. of cone

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

201. r = 7 cm, h = 24 cm.

Now, $\Delta AOB \sim \Delta COD$.



So, $\frac{OA}{OC} = \frac{AB}{CD} \Rightarrow \frac{h}{h/2} = \frac{r}{CD} \Rightarrow CD = \frac{r}{2}$.

$\therefore$ Volume of upper portion

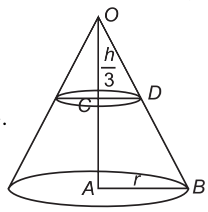
$= \frac{1}{3}\pi\left(\frac{r}{2}\right)^2\left(\frac{h}{2}\right) = \left(\frac{1}{3}\times\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\times 12\right)\text{cm}^3$

$= 154$ cm^3.

202. Let the radius and height of the cone be r and h respectively.

Then, $AB = r$, $OA = h$, $OC = \frac{h}{3}$.

Now, $\Delta AOB \sim \Delta COD$.



$\therefore\ \frac{AB}{CD} = \frac{OA}{OC} \Rightarrow \frac{r}{CD} = \frac{h}{h/3} \Rightarrow CD = \frac{r}{3}$.

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

Volume of smaller cone = $\frac{1}{3}\pi\left(\frac{r}{3}\right)^2\left(\frac{h}{3}\right) = \frac{1}{27}\left(\frac{1}{3}\pi r^2 h\right)$.

Volume of frustum = $\frac{1}{3}\pi r^2 h - \frac{1}{27}\left(\frac{1}{3}\pi r^2 h\right) = \frac{26}{27}\left(\frac{1}{3}\pi r^2 h\right)$.

Hence, required ratio = $\frac{1}{27}\left(\frac{1}{3}\pi r^2 h\right) : \frac{26}{27}\left(\frac{1}{3}\pi r^2 h\right) = 1 : 26$.

203. Volume of bucket = 28.490 litres = (28.490 × 1000) cm^3 = 28490 cm^3.

Let the height of the bucket be h cm.

We have : r = 21 cm, R = 28 cm.

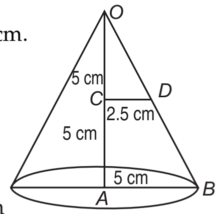
$\therefore\ \frac{\pi}{3}h\left[(28)^2 + (21)^2 + 28\times 21\right] = 28490$

$\Rightarrow h\ (784 + 441 + 588) = \frac{28490\times 21}{22}$

$\Rightarrow 1813\,h = 27195 \Rightarrow h = \frac{27195}{1813} = 15$ cm.

204. We have, $\Delta AOB \sim \Delta COD$.

$\therefore\ \frac{AB}{CD} = \frac{OA}{OC} \Rightarrow \frac{5}{CD} = \frac{10}{5} \Rightarrow CD = \frac{5}{2}$ cm.



Curved surface area of the cone

$= \left[\pi\times 5\times\sqrt{5^2 + (10)^2}\right]\text{cm}^2$

$= 25\sqrt{5}\,\pi\ \text{cm}^2$.

Curved surface area of the frustum

$= \pi\left(5 + \frac{5}{2}\right)\sqrt{\left(5 - \frac{5}{2}\right)^2 + 5^2}$

$= \left(\pi\times\frac{15}{2}\sqrt{\frac{25}{4} + 25}\right)\text{cm}^2 = \left(\pi\times\frac{15}{2}\times\frac{1}{2}\times 5\sqrt{5}\right)\text{cm}^2$

$= \frac{75\sqrt{5}}{4}\pi\ \text{cm}^2$.

Hence, required ratio = $25\sqrt{5}\pi : \frac{75\sqrt{5}}{4}\pi = 4 : 3$.

205. Volume of sphere = $\left(\frac{4}{3}\pi r^3\right)\text{cm}^3$.

Volume of cylinder = $[\pi r^2.(2r)]$ cm^3 = $(2\pi r^3)$ cm^3.

Volume of cone = $\left[\frac{1}{3}\pi r^2\cdot(2r)\right]\text{cm}^3 = \left(\frac{2}{3}\pi r^3\right)\text{cm}^3$.

Clearly, cylinder has the greatest volume.

206. Volume of parallelopiped = (5 × 3 × 4) cm^3 = 60 cm^3.

Volume of cube = $(4)^3$ cm^3 = 64 cm^3.

Volume of cylinder = $\left(\frac{22}{7}\times 3\times 3\times 3\right)\text{cm}^3 = 84.86\ \text{cm}^3$.

Volume of sphere = $\left(\frac{4}{3}\times\frac{22}{7}\times 3\times 3\times 3\right) = 113.14\ \text{cm}^3$.

207. $\frac{4}{3}\times\frac{22}{7}\times r^3 = \frac{45056}{21} \Rightarrow r^3 = \left(\frac{45056}{21}\times\frac{3}{4}\times\frac{7}{22}\right) = 512$

$\Rightarrow r = \sqrt[3]{512} = 8$ cm.

208. $\frac{4}{3}\times\frac{22}{7}\times r^3 = 4851 \Rightarrow r^3 = \left(4851\times\frac{3}{4}\times\frac{7}{22}\right) = \left(\frac{21}{2}\right)^3$

$\Rightarrow r = \frac{21}{2}$.

$\therefore$ Curved surface area

$= \left(4\times\frac{22}{7}\times\frac{21}{2}\times\frac{21}{2}\right)\text{cm}^2 = 1386\ \text{cm}^2$.

209. $4\pi r^2 = 5544 \Rightarrow r^2 = \left(5544 \times \frac{1}{4} \times \frac{7}{22}\right) = 441 \Rightarrow r = 21.$

$\therefore$ Volume $= \left(\frac{4}{3} \times \frac{22}{7} \times 21 \times 21 \times 21\right) \text{cm}^3 = 38808 \text{ cm}^3.$

210. Volume $= \frac{4}{3}\pi r^3 = \frac{r}{3}(4\pi r^2) = \frac{r}{3} \times \text{Surface area}.$

211. Volume of the sphere $= \left[\frac{4}{3}\pi (10)^3\right] \text{cm}^3$. Surface area of the sphere $= [4\pi\ (10)^2]\ \text{cm}^2$.

$\therefore$ Required percentage $= \left[\frac{4\pi (10)^2}{\frac{4}{3}\pi (10)^3} \times 100\right]\% = 30\%.$

212. $\dfrac{\frac{4}{3}\pi r^3}{4\pi r^2} = 27 \Rightarrow r = 81$ cm.

213. Let the radii of the two spheres be r and $4r$ respectively.

Then, required ratio $= \frac{4\pi r^2}{4\pi (4r)^2} = \frac{r^2}{16r^2} = \frac{1}{16} = 1:16.$

214. Let the radii of the two spheres be $3r$ and $2r$ respectively.

Then, required ratio $= \dfrac{\frac{4}{3}\pi (3r)^3}{\frac{4}{3}\pi (2r)^3} = \frac{27}{8} = 27:8.$

215. Let the original radius be r. Then, original surface area $= 4\pi r^2 = 2464\ \text{cm}^2$ (given).

New radius $= 2r$. $\therefore$ New surface area $= 4\pi\ (2r)^2$
$= 4 \times 4\pi r^2 = (4 \times 2464)\ \text{cm}^2 = 9856\ \text{cm}^2$.

216. Let the original radius be r. Then, original volume $= \frac{4}{3}\pi r^3$.

New radius $= 2r$.

$\therefore$ New volume $= \frac{4}{3}\pi (2r)^3 = 8 \times \frac{4}{3}\pi r^3 = 8 \times \text{original volume}.$

217. $4\pi (r+2)^2 - 4\pi r^2 = 352 \Leftrightarrow (r+2)^2 - r^2 = \left(352 \times \frac{7}{22} \times \frac{1}{4}\right) = 28.$

$\Leftrightarrow (r + 2 + r)(r + 2 - r) = 28 \Leftrightarrow 2r + 2 = 14$

$\Rightarrow r = \left(\frac{14}{2} - 1\right) = 6$ cm.

218. Let the correct radius be 100 cm.
Then, measured radius = 101.5 cm.

$\therefore$ Error in volume $= \frac{4}{3}\pi [(101.5)^3 - (100)^3]\ \text{cm}^3$

$= \frac{4}{3}\pi (1045678.375 - 1000000)\ \text{cm}^3$

$= \left(\frac{4}{3} \times \pi \times 45678.375\right) \text{cm}^3.$

$\therefore$ Error % $= \left\{\dfrac{\frac{4}{3}\pi (45678.375)}{\frac{4}{3}\pi (100 \times 100 \times 100)} \times 100\right\}\% = 4.56\%$

$= 4.6\%$ (app.).

219. Let their radii be R and r. Then,

$\dfrac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi r^3} = \frac{64}{27} \Rightarrow \left(\frac{R}{r}\right)^3 = \frac{64}{27} = \left(\frac{4}{3}\right)^3 \Rightarrow \frac{R}{r} = \frac{4}{3}.$

Ratio of surface areas $= \frac{4\pi R^2}{4\pi r^2} = \left(\frac{R}{r}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}.$

220. Let their radii be R and r.

Then, $\frac{4\pi R^2}{4\pi r^2} = \frac{4}{25} \Rightarrow \left(\frac{R}{r}\right)^2 = \left(\frac{2}{5}\right)^2 \Rightarrow \frac{R}{r} = \frac{2}{5}.$

$\therefore$ Ratio of volumes $= \dfrac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi r^3} = \left(\frac{R}{r}\right)^3 = \left(\frac{2}{5}\right)^3 = \frac{8}{125}.$

221. $\frac{4}{3}\pi r^3 = 4\pi r^2 \Rightarrow r = 3.$

222. Volume of new sphere

$= \left[\frac{4}{3}\pi \times (6)^3 + \frac{4}{3}\pi \times (8)^3 + \frac{4}{3}\pi \times (10)^3\right] \text{cm}^3$

$= \left\{\frac{4}{3}\pi [(6)^3 + (8)^3 + (10)^3]\right\} \text{cm}^3$

$= \left(\frac{4}{3}\pi \times 1728\right) \text{cm}^3 = \left[\frac{4}{3}\pi \times (12)^3\right] \text{cm}^3.$

Let the radius of the new sphere be R.

Then, $\frac{4}{3}\pi R^3 = \frac{4}{3}\pi \times (12)^3 \Rightarrow R = 12$ cm.

$\therefore$ Diameter $= 2R = 24$ cm.

223. Volume of bigger sphere

$= \left[\frac{4}{3}\pi \times (8)^3\right] \text{cm}^3 = \left(\frac{4}{3}\pi \times 512\right) \text{cm}^3.$

Volume of 1 ball $= \left[\frac{4}{3}\pi \times (2)^3\right] \text{cm}^3 = \left(\frac{4}{3}\pi \times 8\right) \text{cm}^3.$

$\therefore$ Number of balls $= \left(\dfrac{\frac{4}{3}\pi \times 512}{\frac{4}{3}\pi \times 8}\right) = \frac{512}{8} = 64.$

224. Let the radius of the third ball be R cm. Then,

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

$\Rightarrow \frac{27}{64} + 1 + R^3 = \frac{27}{8} \Rightarrow R^3 = \frac{125}{64} = \left(\frac{5}{4}\right)^3 \Rightarrow R = \frac{5}{4}.$

$\therefore$ Diameter of the third ball $= 2R = \frac{5}{2}$ cm $= 2.5$ cm.

225. Volume of each ball $= \frac{1}{8} \times \left(\frac{4}{3}\pi \times 10 \times 10 \times 10\right) \text{cm}^3.$

Let the radius of each ball be r cm.

Then, $\frac{4}{3}\pi r^3 = \frac{1}{8} \times \left(\frac{4}{3}\pi \times 10 \times 10 \times 10\right) \Rightarrow r^3 = \left(\frac{10}{2}\right)^3 = 5^3$

$\Rightarrow r = 5.$

$\therefore$ Surface area of each ball $= 4\pi r^2 = [4\pi \times (5)^2]\ \text{cm}^2$
$= (100\ \pi)\ \text{cm}^2$.

226. External radius = 3 cm,
Internal radius = (3 – 0.5) cm = 2.5 cm.

Volume of the metal $= \left[\frac{4}{3} \times \frac{22}{7} \times \{(3)^3 - (2.5)^3\}\right] \text{cm}^3$

$= \left(\frac{4}{3} \times \frac{22}{7} \times \frac{91}{8}\right) \text{cm}^3 = \left(\frac{143}{3}\right) \text{cm}^3 = 47\frac{2}{3}\ \text{cm}^3.$

227. Volume of the solid = $(49 \times 33 \times 24)$ cm^3.
Let the radius of the sphere be r.

Then, $\frac{4}{3}\pi r^3 = (49 \times 33 \times 24) \Leftrightarrow r^3 = \left(\frac{49 \times 33 \times 24 \times 3 \times 7}{4 \times 22}\right)$

$= (21)^3 \Leftrightarrow r = 21.$

228. Number of bullets

$$= \frac{\text{Volume of the cube}}{\text{Volume of 1 bullet}} = \left(\frac{22 \times 22 \times 22}{\frac{4}{3} \times \frac{22}{7} \times 1 \times 1 \times 1}\right) = 2541.$$

229. Clearly, the largest sphere that can be carved out of a cube will have a diameter equal to the edge of the cube.

So, radius of the sphere = $\frac{6}{2} = 3$ cm.
$\therefore$ Volume of the sphere

$$= \left(\frac{4}{3} \times \frac{22}{7} \times 3^3\right)\text{cm}^3 = \frac{792}{7}\text{ cm}^3 = 113.14 \text{ cm}^3.$$

230. Volume of each lead shot =

$$\left[\frac{4}{3}\pi \times \left(\frac{0.3}{2}\right)^3\right]\text{cm}^3 = \left(\frac{4}{3} \times \frac{22}{7} \times \frac{27}{8000}\right)\text{cm}^3 = \frac{99}{7000}\text{ cm}^3.$$

$\therefore$ Number of lead shots = $\left(9 \times 11 \times 12 \times \frac{7000}{99}\right) = 84000.$

231. $4\pi R^2 = 6a^2 \Rightarrow \frac{R^2}{a^2} = \frac{3}{2\pi} \Rightarrow \frac{R}{a} = \frac{\sqrt{3}}{\sqrt{2\pi}}.$

$$\frac{\text{Volume of sphere}}{\text{Volume of cube}} = \frac{\frac{4}{3}\pi R^3}{a^3} = \frac{4}{3}\pi \cdot \left(\frac{R}{a}\right)^3 = \frac{4}{3}\pi \cdot \frac{3\sqrt{3}}{2\pi\sqrt{2\pi}}$$

$$= \frac{2\sqrt{3}}{\sqrt{2\pi}} = \frac{\sqrt{12}}{\sqrt{2\pi}} = \frac{\sqrt{6}}{\sqrt{\pi}}.$$

232. Let the edge of the cube be a.
Then, volume of the cube = a^3.
Radius of the sphere = $(a / 2)$.

Volume of the sphere = $\frac{4}{3}\pi\left(\frac{a}{2}\right)^3 = \frac{\pi a^3}{6}.$

$\therefore$ Required ratio = $a^3 : \frac{\pi a^3}{6} = 6 : \pi.$

233. Clearly, the diagonal of the largest possible cube will be equal to the diameter of the sphere.
Let the edge of the cube be a.

$\sqrt{3}a = 2r \Rightarrow a = \frac{2}{\sqrt{3}}r.$ $\therefore$ Volume = $a^3 = \left(\frac{2}{\sqrt{3}}r\right)^3 = \frac{8}{3\sqrt{3}}r^3.$

234. Let the radius of the sphere and that of the right circular cylinder be r.
Then, volume of the cylinder = $\pi r^2 h$.

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

$\therefore$ $\pi r^2 h = \frac{4}{3}\pi r^3 \Rightarrow 3h = 4r \Rightarrow 3h = 2d \Rightarrow \frac{h}{2} = \frac{d}{3}.$

235. $4\pi R^2 = 2\pi \times 6 \times 12 \Rightarrow R^2 = \left(\frac{6 \times 12}{2}\right) = 36 \Rightarrow R = 6$ cm.

236. Let the radius of the cylinder be R.

Then, $\pi \times R^2 \times \frac{7}{3} = \frac{4}{3}\pi \times 7 \times 7 \times 7 \Rightarrow R^2$

$$= \left(\frac{4 \times 7 \times 7 \times 7}{3} \times \frac{3}{7}\right) = 196 = (14)^2 \Rightarrow R = 14 \text{ cm}.$$

$\therefore$ Diameter = $2R$ = 28 cm.

237. Volume of the sphere = Volume of the cylinder

$$\Rightarrow \frac{4}{3}\pi r^3 = \pi R^2 \cdot 2r \Rightarrow 2r^2 = 3R^2 \Rightarrow R^2 = \frac{2r^2}{3} \Rightarrow R = r\sqrt{\frac{2}{3}}.$$

238. Let the radius of the cylinder be r. Then, radius of the sphere = $2r$.

$$\frac{\text{Volume of cylinder}}{\text{Volume of sphere}} = \frac{3}{2} \Rightarrow \frac{\pi r^2 h}{\frac{4}{3}\pi(2r)^3} = \frac{3}{2} \Rightarrow \frac{h}{r} = 16 \Rightarrow h = 16r.$$

$\therefore$ Required ratio = $\frac{\text{Total suface area of cylinder}}{\text{surface area of sphere}}$

$$= \frac{2\pi r \cdot (16r) + 2\pi r^2}{4\pi(2r)^2} = \frac{34\pi r^2}{16\pi r^2} = \frac{17}{8}.$$

239. Required volume = Volume of a sphere of radius 1 cm

$$= \left(\frac{4}{3}\pi \times 1 \times 1 \times 1\right)\text{cm}^3 = \frac{4}{3}\pi \text{ cm}^3.$$

240. Volume of cylinder = $\pi \times (3)^2 \times 15 = 135\pi$ cm^3.

Radius of 1 bullet = $\frac{5}{2}$ mm $= \frac{5}{20}$ cm $= \frac{1}{4}$ cm.

Volume of 1 bullet = $\left(\frac{4}{3}\pi \times \frac{1}{4} \times \frac{1}{4} \times \frac{1}{4}\right)\text{cm}^3 = \frac{\pi}{48}\text{cm}^3.$

$\therefore$ Number of bullets = $\left(135\pi \times \frac{48}{\pi}\right) = 6480.$

241. Let the radius of the cylindrical rod be r.

Then, height of the rod = $8r$ and radius of one ball = $\frac{r}{2}$.

$\therefore$ Number of balls = $\frac{\pi \times r^2 \times 8r}{\frac{4}{3}\pi \times \left(\frac{r}{2}\right)^3} = \left(\frac{8 \times 8 \times 3}{4}\right) = 48.$

242. Let the radius of the sphere be r cm. Then,

$$\frac{4}{3}\pi r^3 = \pi \times (0.1)^2 \times 3600 \Rightarrow r^3 = 36 \times \frac{3}{4} = 27 \Rightarrow r = 3 \text{ cm}.$$

243. Let the length of the wire be h. Then,

$$\pi \times \frac{3}{20} \times \frac{3}{20} \times h = \frac{4}{3}\pi \times 4 \times 4 \times 4$$

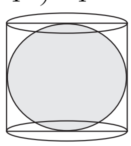
$$\Leftrightarrow h = \left(\frac{4 \times 4 \times 4 \times 4 \times 20 \times 20}{3 \times 3 \times 3}\right)\text{cm} = \left(\frac{102400}{27}\right)\text{cm}$$

$= 3792.5$ cm $= 37.9$ m.

244. Let the rise in the water level be h cm.
Then,

$$\pi \times 4 \times 4 \times h = \frac{4}{3}\pi \times 3 \times 3 \times 3 \Rightarrow h = \left(\frac{3 \times 3}{4}\right) = \frac{9}{4}\text{ cm}.$$

245. Let the radius of the sphere be r.



Then, radius of the cylinder = r.
height of the cylinder = $2r$.
Surface area of sphere = $4\pi r^2$.
Surface area of the cylinder = $2\pi r\ (2r) = 4\pi r^2$.
$\therefore$ Required ratio = $4\pi r^2 : 4\pi r^2 = 1 : 1$.

246. Let the radius of each sphere be r cm.

Then, Volume of 12 spheres = Volume of cylinder

$$\Rightarrow 12\times\frac{4}{3}\pi\times r^3 = \pi\times8\times8\times2 \quad\Rightarrow\quad r^3 = \left(\frac{8\times8\times2\times3}{12\times4}\right)$$

$\Rightarrow r = 2$ cm.

$\therefore$ Diameter of each sphere = $2r$ = 4 cm.

247. Let the radius of the ball be r cm.

Volume of ball = Volume of water displaced by it

$$\therefore \frac{4}{3}\pi r^3 = \pi\times7\times7\times\frac{28}{3} \Rightarrow r^3 = 7^3 \Rightarrow r = 7 \text{ cm.}$$

248. Let the height of the cylinder be h cm.

Then, $\frac{4}{3}\pi[(4)^3-(2)^3] = \pi\times4^2\times h$

$$\Rightarrow \frac{4}{3}\times\pi\times56 = \pi\times16h \Rightarrow h = \frac{4\times56}{3\times16} = \frac{14}{3} \text{ cm.}$$

249. Let the height of the cone be h cm.

Then, $\frac{1}{3}\pi\times8^2\times4 = \frac{4}{3}\pi\times8^3 \Rightarrow h = 32$ cm.

$\therefore$ Slant height, l =

$$\sqrt{h^2+r^2} = \sqrt{(32)^2+8^2} = \sqrt{1088} = 8\sqrt{17} \text{ cm.}$$

250. Let the height of the cone be h cm.

Then, $\frac{4}{3}\pi\times5^3 = \frac{1}{3}\pi\times5^2\times h \Rightarrow h = 20$ cm.

251. Volume of sphere = $\left(\frac{4}{3}\pi\times6^3\right)\text{cm}^3 = (288\,\pi)\text{ cm}^3.$

Volume of each cone = $\left(\frac{1}{3}\pi\times3^2\times4\right)\text{cm}^3 = (12\pi)\text{ cm}^3.$

$\therefore$ Number of cones = $\frac{288\pi}{12\pi} = 24.$

252. Volume of sphere

$= \left[\frac{4}{3}\pi\times(10.5)^3\right]\text{cm}^3$ = $(4\pi \times 10.5 \times 10.5 \times 3.5)$ cm^3.

Volume of each cone

$= \left[\frac{1}{3}\pi\times(3.5)^2\times3\right]\text{cm}^3$ = $(\pi \times 3.5 \times 3.5)$ cm^3.

$\therefore$ Number of cones formed = $\frac{4\pi\times10.5\times10.5\times3.5}{\pi\times3.5\times3.5} = 126.$

253. Volume of sphere = $\left(\frac{4}{3}\pi\times15\times15\times15\right)\text{cm}^3.$

Volume of cone = $\left(\frac{1}{3}\pi\times15\times15\times15\right)\text{cm}^3.$

Volume of wood wasted =

$$\left[\left(\frac{4}{3}\pi\times15\times15\times15\right)-\left(\frac{1}{3}\pi\times15\times15\times15\right)\right]\text{cm}^3.$$

$= (\pi \times 15 \times 15 \times 15)$ cm^3.

$$\therefore \text{Required percentage} = \left(\frac{\pi\times15\times15\times15}{\frac{4}{3}\pi\times15\times15\times15}\times100\right)\% = 75\%.$$

254. Number of spheres = $\frac{\text{Volume of cone}}{\text{Volume of 1 sphere}}$

$$= \frac{\frac{1}{3}\pi\times12\times12\times24}{\frac{4}{3}\pi\times2\times2\times2} = 108.$$

255. Let radius = R and height = H.

Then, Ratio of their volumes

$$= \pi R^2H : \frac{1}{3}\pi R^2H : \frac{4}{3}\pi R^3 = H : \frac{1}{3}H : \frac{4}{3}R$$

$$= H : \frac{1}{3}H : \frac{4}{3}\times\frac{H}{2} = 3:1:2. \quad \left[\text{In sphere, } H = 2R \text{ or } R = \frac{H}{2}\right]$$

256. Volume of hemisphere = $\left(\frac{2}{3}\pi\times3\times3\times3\right)\text{m}^3 = (18\pi)\text{ m}^3.$

257. Total surface area = $3\pi R^2 = \left(3\times\frac{22}{7}\times7\times7\right)\text{cm}^2 = 462\text{ cm}^2.$

258. Let the radius be R cm.

Then, $\frac{2}{3}\times\frac{22}{7}\times R^3 = 19404 \;\Leftrightarrow\; R^3 = \left(19404\times\frac{21}{44}\right) = (21)^3$

$\Leftrightarrow$ R = 21 cm.

259. Let the radius of the hemispherical bowl be r cm.

Then, $2\pi r = 176 \Rightarrow r = \frac{176\times7}{2\times22} = 28.$

Volume of liquid in the bowl $= \frac{1}{2}\times\left(\frac{2}{3}\times\pi\times28\times28\times28\right)\text{cm}^3$

$= \left(\frac{2}{3}\times\pi\times14\times28\times28\right)\text{cm}^3.$

Volume of 1 glass = $\left(\frac{2}{3}\times\pi\times2\times2\times2\right)\text{cm}^3.$

$\therefore$ Required number of persons =

$$\frac{\text{Volume of liquid in the bowl}}{\text{Volume of 1 glass}} = \left(\frac{14\times28\times28}{2\times2\times2}\right) = 1372.$$

260. Let their radii be R and r. Then,

$$\frac{\frac{2}{3}\pi R^3}{\frac{2}{3}\pi r^3} = \frac{6.4}{21.6} \;\Leftrightarrow\; \left(\frac{R}{r}\right)^3 = \frac{8}{27} = \left(\frac{2}{3}\right)^3 \;\Leftrightarrow\; \frac{R}{r} = \frac{2}{3}.$$

$\therefore$ Ratio of curved surface areas = $\frac{2\pi R^2}{2\pi r^2} = \left(\frac{R}{r}\right)^2 = \frac{4}{9}.$

261. Internal radius = 4 cm; External radius = 4.5 cm.

Volume of steel used in making the bowl.

$$= \left[\frac{2}{3}\times\frac{22}{7}\times\{(4.5)^3-4^3\}\right]\text{cm}^3 = \left(\frac{2}{3}\times\frac{22}{7}\times27.125\right)\text{cm}^3$$

$$= \left(\frac{2\times22\times3.875}{3}\right)\text{cm}^3 = \left(\frac{170.5}{3}\right)\text{cm}^3 = 56.83\text{ cm}^3.$$

262. Internal radius, r = 4 cm; External radius, R = 5 cm.

Total surface area = $2\pi R^2 + 2\pi r^2 + \pi(R^2 - r^2)$

$= 3\pi R^2 + \pi r^2 = [\pi(3 \times 25 + 16)]$ cm^2.

$= \left(\frac{22}{7}\times91\right)\text{cm}^2 = 286\text{ cm}^2.$

263. Volume of hemispherical bowl $= \left(\frac{2}{3}\times\pi\times12\times12\times12\right)\text{cm}^3.$

Volume of 1 cylindrical container = $(\pi \times 2 \times 2 \times 3)$ cm^3.

$\therefore$ Number of containers required = $\frac{2}{3}\times\frac{12\times12\times12}{2\times2\times3} = 96.$

264. Let the height of the vessel be x. Then, radius of the bowl $=$ radius of the vessel $= \frac{x}{2}$.

Volume of the bowl, $V_1 = \frac{2}{3}\pi\left(\frac{x}{2}\right)^3 = \frac{1}{12}\pi x^3$.

Volume of the vessel, $V_2 = \pi\left(\frac{x}{2}\right)^2 x = \frac{1}{4}\pi x^3$.

Since $V_2 > V_1$, so the vessel can contain 100% of the beverage filled in the bowl.

265. Let the height of the cylindrical part be h metres.
Volume of the tank = Volume of hemispherical part + Volume of cylindrical part

$= \left(\frac{2}{3} \times \pi \times 12 \times 12 \times 12 + \pi \times 12 \times 12 \times h\right) \text{m}^3$

$= \pi\ (1152 + 144\ h)\ \text{m}^3$

$\therefore\ \pi\ (1152 + 144\ h) = 3312\ \pi \Rightarrow 144\ h = 2160 \Rightarrow h = 15$ m.

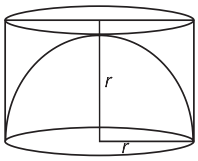
So, ratio of surface areas $= \frac{2\pi r^2}{2\pi rh} = \frac{r}{h} = \frac{12}{15} = 4:5$.

266. Total visible surface area
= Curved surface area of cylinder + Curved surface area of hemisphere =

$$\left[2\pi \times \frac{D}{2} \times H + 2\pi \times \left(\frac{D}{2}\right)^2\right] \text{m}^2 = \left(\pi DH + \frac{\pi D^2}{2}\right) \text{m}^2$$

$$= \left[\frac{\pi D}{2}(2H + D)\right] \text{m}^2.$$

267. Let the radius of the hemisphere be r cm.



Then, radius of the cylinder $= r$ cm.

height of the cylinder $= r$ cm.

$\therefore$ Required ratio =

$$\frac{\text{Volume of hemisphere}}{\text{Volume of cylinder}} = \frac{\frac{2}{3}\pi r^3}{\pi r^2 \times r} = \frac{2}{3}.$$

268. $\frac{2}{3}\pi R^3 = \frac{1}{3}\pi R^2 H \quad \Rightarrow \quad H = 2R.$

269. Let the radius of the cone be R cm.

Then, $\frac{1}{3}\pi \times R^2 \times 75 = \frac{2}{3}\pi \times 6 \times 6 \times 6$

$$\Leftrightarrow R^2 = \left(\frac{2 \times 6 \times 6 \times 6}{75}\right) = \left(\frac{144}{25}\right) = \left(\frac{12}{5}\right)^2 \Leftrightarrow R = \frac{12}{5}\text{ cm} = 2.4\text{ cm}.$$

270. Let the radius of each be R. Height of hemisphere, $H = R$.
So, height of cone = height of hemisphere $= R$.

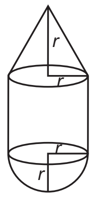
Slant height of cone $= \sqrt{R^2 + R^2} = \sqrt{2}\ R$.

$$\frac{\text{Curved surface area of hemisphere}}{\text{Curved surface area of cone}} = \frac{2\pi R^2}{\pi R \times \sqrt{2}\ R} = \sqrt{2}:1.$$

271. Required ratio = Volume of cone : Volume of cylinder : Volume of hemisphere

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

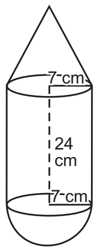
272. Total volume of the body



= Volume of the cylinder + Volume of the cone + Volume of the hemisphere

$= \pi r^2.r + \frac{1}{3}\pi r^2 \cdot r + \frac{2}{3}\pi r^3 = 2\pi r^3 = 2\pi.\ (2)^3 = 16\pi.$

273. Surface area of the solid =

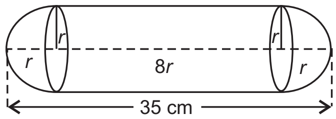


= Curved surface area of cone
+ Curved surface area of cylinder
+ Curved surface area of hemisphere

$$= \left(\begin{array}{c}\pi \times 7 \times \sqrt{7^2 + (24)^2} + 2\pi \times 7 \\ \times 24 + 2\pi \times 7 \times 7\end{array}\right) \text{cm}^2$$

$= (175\pi + 336\pi + 98\pi)\ \text{cm}^2 = (609\pi)\ \text{cm}^2$.

274. Let the radius of the cylinder and the hemisphere be r cm.
Diameter of the cylinder $= (2r)$ cm.
Height of the cylinder $= (4 \times 2r)$ cm $= (8r)$ cm.
Total length of the solid $= (8r + r + r)$ cm $= (10r)$ cm.
$10r = 35 \Rightarrow r = 3.5$ cm.



$\therefore$ Surface area of the solid
= Curved surface area of the cylinder
+ 2 × (curved surface area of the hemisphere)

$= \left(2 \times \frac{22}{7} \times 3.5 \times 28 + 2 \times 2 \times \frac{22}{7} \times 3.5 \times 3.5\right) \text{cm}^2$

$= (616 + 154)\ \text{cm}^2 = 770\ \text{cm}^2$.

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

Volume of biggest sphere = Volume of sphere with diameter $r = \frac{4}{3}\pi\left(\frac{r}{2}\right)^3 = \frac{1}{6}\pi r^3$.

$\therefore$ Required ratio $= \frac{\frac{2}{3}\pi r^3}{\frac{1}{6}\pi r^3} = \frac{4}{1}$ *i.e.* $4:1$.

276. Volume of pyramid =

$\frac{1}{3} \times \text{area of base} \times \text{height} = \left(\frac{1}{3} \times 25 \times 9\right) \text{cm}^3 = 75\ \text{cm}^3$.

277. Volume of pyramid $= \left(\frac{1}{3} \times 8^2 \times 30\right) \text{cm}^3 = 640\ \text{cm}^3$.

or 640 CC

278. Area of the base $= \left(\frac{\sqrt{3}}{4} \times 1^2\right) \text{m}^2 = \frac{\sqrt{3}}{4} \text{m}^2$.

$\therefore$ Volume of pyramid $= \left(\frac{1}{3} \times \frac{\sqrt{3}}{4} \times 4\right) \text{m}^3 = \left(\frac{\sqrt{3}}{3}\right) \text{m}^3$

$= \left(\frac{1.732}{3}\right) \text{m}^3 = 0.577\ \text{m}^3$.

279. Area of hexagonal base $= \left[\frac{3\sqrt{3}}{2} \times (10)^2\right] \text{m}^2 = 150\sqrt{3}\ \text{m}^2$.

$\therefore$ Volume of pyramid $= \left(\frac{1}{3} \times 150\sqrt{3} \times 60\right) \text{m}^3 = 3000\sqrt{3}\ \text{m}^3$

$= (3000 \times 1.732)\ \text{m}^3 = 5196\ \text{m}^3$.

280. Area of base = $\left(\frac{\sqrt{3}}{4}\times 1^2\right)\text{m}^2 = \frac{\sqrt{3}}{4}\text{m}^2$.

Clearly, the pyramid has 3 triangular faces each with sides 3 m, 3 m and 1 m.

So, area of each lateral face

$= \sqrt{\frac{7}{2}\times\left(\frac{7}{2}-3\right)\left(\frac{7}{2}-3\right)\left(\frac{7}{2}-1\right)}\text{m}^2 \quad \left[\because s = \frac{3+3+1}{2} = \frac{7}{2}\right].$

$= \sqrt{\frac{7}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{5}{2}}\ \text{m}^2 = \frac{\sqrt{35}}{4}\ \text{m}^2.$

$\therefore$ Whole surface area of the pyramid

$= \left(\frac{\sqrt{3}}{4}+3\times\frac{\sqrt{35}}{4}\right)\text{m}^2 = \frac{\sqrt{3}+3\sqrt{35}}{4}\ \text{m}^2.$

281. Let the height of the pyramid be h units.

Then, volume of the pyramid

$= \left[\frac{1}{3}\times\left(\frac{\sqrt{3}}{4}\times 4\times 4\right)\times h\right]\text{cu. units} = \left(\frac{4h}{\sqrt{3}}\right)\text{cu. units.}$

Whole surface area of the pyramid

$= \left[4\times\left(\frac{\sqrt{3}}{4}\times 4\times 4\right)\right]\text{sq. units.} = (16\sqrt{3})\text{ sq. units}$

$\therefore\ 16\sqrt{3} = 3\times\left(\frac{4h}{\sqrt{3}}\right) \Rightarrow h = 4\text{ units.}$

282. Length of each edge of a regular tetrahedron

= 1 cm

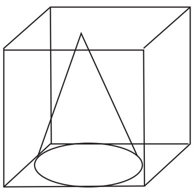
Volume of regular tetrahedron

$= \frac{a^3}{6\sqrt{2}}\ \text{cm}^3$

$= \frac{1}{6\sqrt{2}} = \frac{\sqrt{2}}{6\sqrt{2}\times\sqrt{2}}\ \text{cu.cm}$

$= \frac{\sqrt{2}}{12}\ \text{cu.cm.}$

283.



The volume of cone should be maximum.

$\therefore$ Radius of the base of cone

$= \frac{\text{Edge of cube}}{2} = \frac{4.2}{2} = 2.1\text{ dm.}$

Height of cone = Edge of cube = 4.2 dm.

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

$= \left(\frac{1}{3}\times\frac{22}{7}\times 2.1\times 2.1\times 4.2\right)\text{cu.dm.}$

= 19.404 cu.dm.

284. Let the length of base be $3a$ cm and breadth be $2a$ cm

Total surface area of prism

= [perimeter of base × height] + [2 × area of base]

$= [2(3a+2a)\times 12 + 2\times 3a\times 2a]$ sq. cm.

$= (120a+12a^2)$ sq. cm.

According to the question,

$120a+12a^2 = 288$

$\Rightarrow a^2+10a = 24$

$\Rightarrow a^2+10a-24 = 0$

$\Rightarrow a^2+12a-2a-24 = 0$

$\Rightarrow a(a+12)-2(a+12) = 0$

$\Rightarrow (a-2)(a+2) = 0$

$\Rightarrow a = 2$ because $a \neq -12$

$\therefore$ Volume of prism = Area of base × height

$= (3a\times 2a\times 12)$ cu. cm.

$= 72a^2 = (72\times 2\times 2)$ cu.cm.

= 288 cu.cm.

285. Let the height of the cylinder be x m.

Then, radius = $(x + 5)$m

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

Now, $2\pi(x+5)\times x = 792$

$2\times\frac{22}{7}\times(x^2+5x) = 792$

$x^2+5x = \frac{792\times 7}{44} = 126$

$\Rightarrow x^2+5x = 126$

$x^2+5x-126 = 0$

$x^2+14x-9x-126 = 0$

$x(x+14)-9(x+14) = 0$

$(x-9)(x+14) = 0$

$\therefore$ x = 9, –14 (neglect negative value)

$\therefore$ Height of cylinder = 9m

$\therefore$ Radius of cylinder = 9 + 5 = 14m

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

$= \frac{22}{7}\times 14\times 14\times 9 = 5544\,\text{m}^3$

286. Radius of base = r units

Curved surface area of a right cylinder = $4\pi rh$

Curved surface area of cylinder = 2πRH

$\therefore$ According to the question, $2\pi r$H = $4\pi r$h

$\Rightarrow$ Height of cylinder = $2h$ units

287. Radius of a hemispherical bowl = 3.5cm

Inner and outer surface areas of the bowl = $4\pi r^2$

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

= 154 sq. cm.

Total cost of painting at the rate of ₹ 5 per 10 sq. cm.

$= 154\times\frac{5}{10}$ = ₹ 77

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

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

$\therefore\ \frac{\pi r^2 h}{2\pi rh} = \frac{616}{352}$

$\Rightarrow\ r = \frac{2 \times 616}{352} = 3.5\text{ m}$

$\therefore$ volume of cylinder = $\pi r^2 h$ = 616

$\Rightarrow\ \frac{22}{7} \times 3.5 \times 3.5 \times h = 616$

$\Rightarrow$ 11 × 3.5 × h = 616

$\Rightarrow\ h = \frac{616}{11 \times 3.5} = 16$

$\therefore$ Total surface area of the cylinder

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

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

$= 2 \times \frac{22}{7} \times 3.5(16 + 3.5)$

$= 2 \times \frac{22}{7} \times 3.5(19.5)$

= 22 × 19.5 = 429 sq. m.

289. Radius of hemisphere bowl = 6cm

$\therefore$ Volume of hemisphere = $\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 6 \times 6 \times 6$

$= \frac{9504}{21} = 452.57\text{ cm}^3$

290. Let the side of cube = 10cm

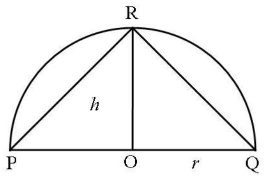
$\therefore$ Original volume = 10 × 10 × 10 = 1000 cm^3

Now, side of new cube = 10 – 25% of 10 = 7.5cm

$\therefore$ New volume = 7.5 × 7.5 × 7.5 = 421.875cm^3

$\therefore$ Required Ratio = $\frac{1000}{421.875} = \frac{1000000}{421875} = \frac{64}{27}$ = 64 : 27

291.



Let

OP = OQ = OR = r

$\therefore$ OR = h = r

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

Curved surface area of a cone = πrl

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

$\therefore$ Required ratio = $\frac{2\pi r^2}{\pi rl} = \frac{2\pi r^2}{\pi r \cdot r\sqrt{2}}$

$= \frac{2}{\sqrt{2}} = \frac{2 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{2\sqrt{2}}{2} = \frac{\sqrt{2}}{2} = \frac{\sqrt{2}}{1} = \sqrt{2} : 1$

292. Length of parallel sides of prism = 10cm and 6cm

Height of prism = 8cm

$\therefore$ Volume of prism = $\frac{1}{2}(10 + 6) \times 5 \times 8$

$= \frac{1}{2} \times 16 \times 5 \times 8$ = 320 cm^3

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

Then, r + h = 19 ....(i)

Again, total surface area of cylinder = ($2\pi rh$ + $2\pi r^2$)

Now, $2\pi r(h + r) = 1672$

Or, $2\pi r \times 19 = 1672$

Or $38\pi r = 1672$

$\therefore\ \pi r = \frac{1672}{38} = 44\text{ m}$

$\therefore\ r = \frac{44 \times 7}{22} = 14$

$\therefore$ Height = 19 – 14 = 5m

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

$= \frac{22}{7} \times 14 \times 14 \times 5$

= 22 × 2 × 14 × 5 = 3080m^3

294. Let radius of sphere be r cm.

$\therefore$ Volume of sphere = volume of cuboid

$\Rightarrow\ \frac{4}{3}\pi r^2 = L \times b \times h$

$\Rightarrow\ \frac{4}{3}\pi r^3 = 49 \times 33 \times 24$

$\Rightarrow\ \frac{4}{3} \times \frac{22}{7} \times r^3 = 49 \times 33 \times 24$

$\Rightarrow\ r^3 = \frac{49 \times 33 \times 24 \times 3 \times 7}{4 \times 22}$

$\Rightarrow\ r^3 = 9261$

$\therefore\ r = \sqrt[3]{9261} = \sqrt[3]{21 \times 21 \times 21} = 21\text{ cm.}$

295. Diameter of bowl = 7cm

$\therefore$ Radius of bowl = $\frac{2}{7}$ cm.

Height = 4cm

$\therefore$ Volume of cylindrical bowl = $\pi r^2 h$

$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 4$ = 154 cu.cm

Hence, volume of soup for 250 patients = 154 × 250

= 38500 cm^3 = 38.5L.

296. Let the radius of the sphere be R and length of each side of the cube = a

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

Surface area of a cube = $6a^2$

$\Rightarrow\ 4\pi r^2 = 6a^2$

$\Rightarrow\ \frac{R^2}{a^2} = \frac{6}{4\pi} = \frac{3}{2\pi}$

Radio of the square of the volumes

$= \frac{\left(\frac{4}{3}\pi R^3\right)^2}{\left(a^3\right)^2}$

$= \frac{16}{9}\left(\frac{\pi^2 \cdot R^6}{a^6}\right)$

$\Rightarrow\ \frac{16\pi^2}{9}\left(\frac{R^2}{a^2}\right)^3$

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

$$= \frac{16}{9}\pi^2 \times \frac{27}{8\pi^3}$$

$$= \frac{16\times 27}{9\times 8\pi}$$

$$= \frac{6}{\pi} = 6 : \pi$$

297. Let the radius of cone and the sphere be R and the height of the cone be H.

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

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

According to given information = $\frac{4}{3}\pi R^3 = 2\times\frac{1}{3}\pi R^2 H$

$\Rightarrow 4R = 2h$

$\Rightarrow \frac{H}{R} = \frac{4}{2} = 2:1$

298. Length of rectangle paper = circumference of the base of cylinder

If r is the radius of the cylinder $44 = 2\pi r$

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

299. Given Raddi of three metallic spheres be r_1, r_2 r_3 are 6cm, 8cm and 10cm respectively.

Let the radius of the new sphere be R.

$$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi\left(r_1^3 + r_2^3 + r_3^3\right)$$

$$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi\left(6^3 + 8^3 + 10^3\right)$$

$$R^3 = (216 + 512 + 1000) = 1728$$

$\Rightarrow R = \sqrt[3]{12\times 12\times 12}$

$R = 12$

Diameter = 24cm

300. Let the radius of a right circular cone be R cm and height be H cm.

Volume of right circular cone = $\frac{1}{3}\pi R^2 H$ cu.cm.

When height of right circular cone is increased by 200% and radius of the base is reduced by 50%.

New volume $= \frac{1}{3}\pi\left(\frac{R}{2}\right)^2 \cdot 3H$

$$= \frac{1}{3}\pi\frac{R^2 4}{4}\cdot 3H = \frac{\pi R^2 H}{4}$$

Difference $= \pi R^2 H\left(\frac{1}{3} - \frac{1}{4}\right) = \frac{1}{12}\pi R^2 H$

Decrease percentage = $\dfrac{\frac{1}{12}\pi R^2 H}{\frac{1}{3}\pi R^2 H}\times 100 = 25\%$

301. If R is the radius of sphere, volume of the sphere $= \frac{4}{3}\pi R^3$.

When radius of sphere is increased by 10%.

New volume $= \frac{4}{3}\pi(1.1R)^3$

$= \frac{4}{3}\pi R^3(1.331)$

Difference $= \frac{4}{3}\pi R^3(1.331) - \frac{4}{3}\pi R^3 = \frac{4}{3}\pi R^3(1.331 - 1)$

$= \frac{4}{3}\pi R^3(0.331)$

Increase% $= \dfrac{\frac{4}{3}\pi R^3(0.331)}{\frac{4}{3}\pi R^3}\times 100 = 33.1\%$

302. Ball is dropped from the height of 36m when the ball will rise at the third bounce

Required height = $\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times 36$

$= \frac{32}{3} = 10\frac{2}{3}$ m.

303. Given length of width of swimming pool is 9m and 12m respectively.

Volume of swimming pool = $9\times 12\times\left(\frac{1+4}{2}\right)$

$= 9\times 12\times\frac{5}{2} = 270$ cu. meter.

304. Let Edge of third small cube be x cm

Volume of cube = $(\text{edge})^3$

According to the question, $6^3 + 8^3 + x^3 = 12^3$

$\Rightarrow 216 + 512 + x^3 = 1728$

$x^3 = 1728 - 728 = 1000$

$\Rightarrow x = \sqrt[3]{1000} = 10$ cm

EXERCISE

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (*Questions 1 to 10*): *Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the given question. Read both the statements and*

Give answer (**a**) *if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;*

Give answer (**b**) *if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;*

Give answer (**c**) *if the data either in Statement I or in Statement II alone are sufficient to answer the question;*

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

1. What is the weight of the iron beam?
I. The beam is 9 m long, 40 cm wide and 20 cm high.
II. Iron weighs 50 kg per cubic metre.

2. What is the volume of 32 metre high cylindrical tank?
I. The area of its base is 154 m^2.
II. The diameter of the base is 14 m.

3. What is the volume of a cube?
I. The area of each face of the cube is 64 square metres.
II. The length of one side of the cube is 8 metres.

4. How much cardboard will it take to make an open cubical box with no top?
I. The area of the bottom of the box is 4 square meters.
II. The volume of the box is 8 cubic metres.

5. What is the total cost of painting the inner surface of an open box at the rate of 50 paise per 100 sq. cm?
I. The box is made of wood 3 cm thick.
II. The external dimensions of the box are 50 cm, 40 cm and 23 cm.

6. What is the capacity of a cylindrical tank?
I. Radius of the base is half of its height which is 28 metres.
II. Area of the base is 616 sq. metres and its height is 28 metres.

7. What is the volume of the cylinder?
I. Height is equal to the diameter.
II. Perimeter of the base is 352 cm.

8. What will be the total cost of whitewashing the conical tomb at the rate of 80 paise per square metre?
I. The diameter and the slant height of the tomb are 28 m and 50 m.
II. The height of the tomb is 48 m and the area of its base is 616 sq. m.

9. What is the height of a circular cone?
I. The area of that cone is equal to the area of a rectangle whose length is 33 cm.
II. The area of the base of that cone is 154 sq. cm.

10. Is a given rectangular block, a cube?
I. At least 2 faces of the rectangular block are squares.
II. The volume of the block is 64.

11. A spherical ball of given radius x cm is melted and made into a right circular cylinder. What is the height of the cylinder?
I. The volume of the cylinder is equal to the volume of the ball.
II. The area of the base of the cylinder is given.

12. What is the ratio of the volume of the given right circular cone to the one obtained from it?
I. The smaller cone is obtained by passing a plane parallel to the base and dividing the original height in the ratio 1 : 2.
II. The height and the base of the new cone are one-third those of the original cone.

Directions (*Questions 13 to 16*): ***Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.***

13. What is the capacity of the cylindrical tank?
I. The area of the base is 61,600 sq. cm.
II. The height of the tank is 1.5 times the radius.
III. The circumference of base is 880 cm.
(*a*) Only I and II (*b*) Only II and III
(*c*) Only I and III (*d*) Any two of the three
(*e*) Only II and either I or III

14. What is the capacity of the cylindrical tank? **(Bank. P.O., 2008)**
I. Radius of the base is half of its height.
II. Area of the base is 616 square metres.
III. Height of the cylinder is 28 metres.
(*a*) Only I and II (*b*) Only II and III
(*c*) Only I and III (*d*) All I, II and III
(*e*) Any two of the three

15. A solid metallic cone is melted and recast into a sphere. What is the radius of the sphere?
I. The radius of the base of the cone is 2.1 cm.
II. The height of the cone is four times the radius of its base.
III. The height of the cone is 8.4 cm.
(*a*) Only I and II (*b*) Only II and III
(*c*) Only I and III (*d*) Any two of the three
(*e*) All I, II and III

16. What is the total surface area of the cone?
I. The area of the base of the cone is 154 cm^2.
II. The curved surface area of the cone is 550 cm^2.
III. The volume of the cone is 1232 cm^3.
(*a*) I, and either II or III (*b*) II, and either I or III
(*c*) III, and either I or II (*d*) Any two of the three
(*e*) None of these

ANSWERS

1. (*e*)	**2.** (*c*)	**3.** (*c*)	**4.** (*c*)	**5.** (*e*)	**6.** (*c*)	**7.** (*e*)	**8.** (*c*)	**9.** (*d*)	**10.** (*d*)
11. (*b*)	**12.** (*c*)	**13.** (*e*)	**14.** (*e*)	**15.** (*d*)	**16.** (*a*)				

SOLUTIONS

1. **I.** gives, $l = 9\text{ m}, b = \frac{40}{100}\text{ m} = \frac{2}{5}\text{ m}$ and $h = \frac{20}{100}\text{ m} = \frac{1}{5}\text{ m}.$

This gives, volume

$= (l \times b \times h) = \left(9 \times \frac{2}{5} \times \frac{1}{5}\right)\text{m}^3 = \frac{18}{25}\text{m}^3.$

II. gives, weight of iron is 50 kg / m^3.

$\therefore$ Weight $= \left(\frac{18}{25} \times 50\right)\text{kg} = 36\text{ kg}.$

Thus, both I and II are needed to get the answer.
$\therefore$ Correct answer is (*e*).

2. Given, height = 32 m.

I. gives, area of the base = 154 m^2.
$\therefore$ Volume = (area of the base × height)
$= (154 \times 32)\text{ m}^3 = 4928\text{ m}^3.$

Thus, I alone gives the answer.

II. gives, radius of the base = 7 m.

$\therefore$ Volume $= \pi r^2 h = \left(\frac{22}{7} \times 7 \times 7 \times 32\right)\text{m}^3 = 4928\text{ m}^3.$

Thus, II alone gives the answer.
$\therefore$ Correct answer is (*c*).

3. Let each edge be a metres. Then,

I. $a^2 = 64 \Rightarrow a = 8$ m
$\Rightarrow$ Volume = $(8 \times 8 \times 8)\text{ m}^3 = 512\text{ m}^3$.
Thus, I alone gives the answer.

II. $a = 8$ m $\Rightarrow$ Volume = $(8 \times 8 \times 8)\text{ m}^3 = 512\text{ m}^3$.
Thus, II alone gives the answer.
$\therefore$ Correct answer is (*c*).

4. **I.** Let the length of each edge of the box be a metres. Then, $a^2 = 4 \Rightarrow a = 2$ m.

$\therefore$ Area of the cardboard needed
$= 5a^2 = (5 \times 2^2)\text{ m}^2 = 20\text{ m}^2.$

Thus, I alone gives the answer.

II. $a^3 = 8 \Rightarrow a = 2$ m.

$\therefore$ Required area $= 5a^2 = (5 \times 2^2)\text{ m}^2 = 20\text{ m}^2$.

Thus, II alone gives the answer. So, correct answer is (*c*).

5. **I.** gives, thickness of the wall of the box = 3 cm.

II. gives, Internal length = (50 – 6) cm = 44 cm,
Internal breadth = (40 – 6) = 34 cm,
Internal height = (23 – 3) cm = 20 cm.

Area to be painted = (area of 4 walls + area of floor) = $[2(l + b) \times h + (l \times b)]$
$= [2(44 + 34) \times 20 + (44 \times 34)]\text{ cm}^2 = 4616\text{ cm}^2$.

Cost of painting = ₹ $\left(\frac{1}{2 \times 100} \times 4616\right)$ = ₹ 23.08.

Thus, both I and II are needed to get the answer.
$\therefore$ Correct answer is (*e*).

6. **I.** gives, $h = 28$ m and $r = 14$ cm.
$\therefore$ Capacity = $\pi r^2 h$, which can be obtained.
Thus, I alone gives the answer.

II. gives, $\pi r^2 = 616\text{ m}^2$ and $h = 28$ m.
$\therefore$ Capacity = $(\pi r^2 \times h) = (616 \times 28)\text{ m}^3$.
Thus, II alone gives the answer.
$\therefore$ Correct answer is (*c*).

7. **I.** gives, $h = 2r$.

II. gives, $2\pi r = 352 \Rightarrow r = \left(\frac{352}{2} \times \frac{7}{22}\right)\text{cm} = 56\text{ cm}.$

From I and II, we have $r = 56$ cm,
$h = (2 \times 56)$ cm = 112 cm.
Thus, we can find the volume.
$\therefore$ Correct answer is (*e*).

8. **I.** gives, $r = 14$ m, $l = 50$ m.

$\therefore$ Curved surface $= \pi rl = \left(\frac{22}{7} \times 14 \times 50\right)\text{m}^2 = 2200\text{ m}^2.$

Cost of whitewashing = ₹ $\left(2200 \times \frac{80}{100}\right)$ = ₹ 1760.

Thus, I alone gives the answer.

II. gives, $h = 48$ m, $\pi r^2 = 616\text{ m}^2$. These results give r and h and so l can be found out.
$\therefore$ Curved surface = πrl.
Thus, II alone gives the answer.
$\therefore$ Correct answer is (*c*).

9. **II.** gives the value of r.
But, in I, the breadth of rectangle is not given. So, we cannot find the surface area of the cone. Hence, the height of the cone cannot be determined.
$\therefore$ Correct answer is (*d*).

10. **I.** gives, any two of l, b, h are equal.

II. gives, $lbh = 64$.
From I and II, the values of l, b, h may be (1, 1, 64), (2, 2, 16), (4, 4, 4).
Thus, the block may be a cube or cuboid.
$\therefore$ Correct answer is (*d*).

11. Clearly, I is not needed, since it is evident from the given question.
From II, we get radius of the base of the cylinder.

Now, $\frac{4}{3}\pi x^3 = \pi r^2 h$ in which x and r are known.

$\therefore$ h can be determined.
$\therefore$ Correct answer is (*b*).

12. I. Let the radius and height of the bigger cone be r and h respectively and let its volume be V_1.

Then, radius of smaller cone $= \frac{r}{2}$. And, height of smaller cone $= \frac{h}{2}$.

Let the volume of the smaller cone be V_2. Then,

$$\frac{V_1}{V_2} = \frac{\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi\left(\frac{r}{2}\right)^2\left(\frac{h}{2}\right)} = \frac{8}{1}.$$

Thus, I alone gives the answer.

II. Let the radius and height of the bigger cone be r and h respectively and let its volume be V_1.

Then, radius of smaller cone $= \frac{r}{3}$. And, height of smaller cone $= \frac{h}{3}$.

Let the volume of the smaller cone be V_2. Then,

$$\frac{V_1}{V_2} = \frac{\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi\left(\frac{r}{3}\right)^2\left(\frac{h}{3}\right)} = \frac{27}{1}.$$

Thus, II alone gives the answer.
$\therefore$ Correct answer is (*c*).

13. Capacity $= \pi r^2 h$.

I. gives, $\pi r^2 = 61600$. This gives r.

II. gives, $h = 1.5\ r$.

Thus, I and II give the answer. Again,

III. gives $2\pi r = 880$. This gives r.

So, II and III also give the answer.
$\therefore$ Correct answer is (*e*).

14. I & II. $\pi r^2 = 616 \Rightarrow r^2 = \frac{616 \times 7}{22} = 196 \Rightarrow r = 14$ m.

So, $h = 28$ m.

$\therefore$ Capacity $= \left(\frac{22}{7} \times 14 \times 14 \times 28\right) \text{m}^3 = 17248 \text{ m}^3$.

II & III. $\pi r^2 = 616 \Rightarrow r = 14$ m. And, $h = 28$ m.

$\therefore$ Capacity $= \left(\frac{22}{7} \times 14 \times 14 \times 28\right) \text{m}^3 = 17248 \text{ m}^3$.

II & III. $h = 28$ m and $r = \frac{h}{2} = 14$ m.

$\therefore$ Capacity $= \left(\frac{22}{7} \times 14 \times 14 \times 28\right) \text{m}^3 = 17248 \text{ m}^3$.

Thus, any two of the three given statements are sufficient.
$\therefore$ Correct answer is (*e*).

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

Now r and h can be determined from any two of I, II and III. Thus, R can be calculated.
$\therefore$ Correct answer is (*d*).

16. Total surface area of the cone $= (\pi rl + \pi r^2)$ cm^2.

I. gives, $\pi r^2 = 154$. Thus, we can find r.

II. gives, $\pi rl = 550$.

From I and II we get the answer.

III. gives, $\frac{1}{3}\pi r^2 h = 1232$.

From I and III, we can find h and therefore, l. Hence the surface area can be determined.
$\therefore$ Correct answer is (*a*).