16. Surface area and volume

1. A field is in the form of a rectangle of length 18m and width 15m. A cuboid shaped 7.5 m long, 6m broad and 0. 8 m deep is dug in a corner of the field and the earth taken out is spread over the remaining area of the field. Find out the extent to which the level of the field has been raised.

Solution : Length of the field (L) = 18 m

Width of the field (B) = 15 m

Length of the pit (*l*) = 7.5 m

Breadth of the pit (b) = 6 m

Depth of the pit (b) = 0.8 m

We have to find the level of field raised.

∴ Volume of the earth dug out

$$V = l \times b \times h$$

$$= (7.5 \times 6 \times 0.8)\ m^3 = 36\ m^3$$

The area on which the earth has to be spread = Area of the rectangular field − Area of the cuboid shaped pit

First find out the are of rectangular field.

$\therefore$ **Area of rectangular field = length of the field $\times$ breadth of the field**

$\mathbf{18 \times 15 = 270\ m^3}$ **...... (I)**

Now find the area of the cuboid shaped pit. But cuboid has a rectangular surface.

$\therefore$ **Area of a pit $=$ Length of a pit $\times$ Breadth of a pit**

$$\mathbf{= 7.5 \times 6}$$

$$\mathbf{= 45\ sq.\ m.\ ......\ (II)}$$

$\therefore$ **The area on which the earth has to be spread $=$ Area of the rectangular field $-$ Area of a pit**

$\mathbf{= 270 - 45}$ **...... (From I and II)**

$\mathbf{= 225\ m^2}$

The rise in the level of the field

$$= \frac{\text{Volume of the earth dug out}}{\text{The area on which the earth has to be spread}}$$

$$= \frac{36\ \mathrm{m}^3}{225\ \mathrm{m}^2}$$

$$= \frac{4}{25}\ \mathrm{m}$$

$$= 0.16\ \mathrm{m}$$

But 1m = 100 m

Convert 0. 16 m into centimeter

$\therefore$ 0.16 m = 0.16×100 cm = 16 cm

$\therefore$ The level of the field has been raised to 16 cm.

2. The external dimensions of a closed wooden box are 48 cm, 36 cm, 30 cm. The box is made of 1.5 cm thick wood. How many bricks of size 6 cm $\times$ 3 cm $\times$ 0.75 cm can be put in this box.

Solution : External dimensions of the closed wooden box.

Length (L) = 48 cm, Breadth (B) = 36 cm Height (H) = 30 cm

Thickness of the wood (t) = 1.5 cm

We need the find number bricks that can be put inside the box of dimension

6 cm $\times$ 3 cm $\times$ 0.75 cm

Internal dimensions of the box,

Length (*l*) $= \mathbf{L - 2t}$

$$= 48 - 2 \times 1.5$$

$$= 48 - 3$$

$$= 45 \text{ cm}$$

Breadth (b) $= B - 2t$

$$= 36 - 2 \times 1.5$$

$$= 36 - 3$$

$$= 33 \text{ cm}$$

Height (b) $= H - 2t$

$$= 30 - 2 \times 1.5$$

$$= 30 - 3$$

$$= 27 \text{ cm}$$

Volume of the box, $(V) = l \times b \times h$

$$= (45 \times 33 \times 27)\text{cm}^3 \quad \text{..... (I)}$$

Volume of each brick (v) $= (6 \times 3 \times 0.75)\ \text{cm}^3$ ...... (II)

Number of bricks that can be put in the box,

$$= \frac{\text{Volume of a box}}{\text{Volume of the brick}}$$

$$= \frac{45 \times 33 \times 27}{6 \times 3 \times 0.75} \quad \text{..... [From (I) \& (II)]}$$

$$= \frac{45 \times 33 \times 9}{6 \times 0.75}$$

$$= \frac{45 \times 11 \times 9}{2 \times 0.75}$$

$$= \frac{45 \times 11 \times 9}{1.5}$$

$$= \frac{45 \times 11 \times 9}{\frac{15}{10}} \qquad \ldots\ldots \left(1.5 = \frac{15}{1} = \frac{1.5 \times 10}{1 \times 10} = \frac{15}{10}\right)$$

$$= \frac{45 \times 11 \times 9 \times 10}{15}$$

$$= 3 \times 11 \times 9 \times 10$$

$$= 2970$$

∴ **The box can contain 2970 bricks.**

3. A single solid cube of metal of a edge 12 cm is melted & formed three smaller cubes. Find the edge of third smaller cube if the edge of remaining two smaller cubes are 6 cm and 8 cm respectively.

Solution : Suppose V be the volume of a solid cube and '*a*' be the edge of a solid cube. Let a_1 , a_2 , a_3 are the edges of a cube and v_1 , v_2 , v_3 are the volume of a cube.

$a = 12$ cm , $a_1 = 6$ cm , $a_2 = 8$ cm …… (Given)

Volume of a solid cube = Sum of the volume of three small cubes.

$\therefore V = v_1 + v_2 + v_3$

Volume of cube $= (\text{Side})^3$ **...... (Formula)**

$\therefore (\text{Side})^3 = a^3 = (a_1)^3 + (a_2)^3 + (a_3)^3$

$\therefore (12)^3 = (6)^3 + (8)^3 + (a_3)^3$

$\therefore 1728 = 216 + 512\ (a_3)^3$

$\therefore 1728 = 728 + (a_3)^3$

$\therefore (a_3)^3 = 1728 - 728$

$\therefore (a_3)^3 = 1000$

$\therefore (a_3)^3 = (10)^3$

$\therefore a_3 = 10\ \text{cm}$

∴ The edge of the third cube is 10 cm.

4. The breadth of a hall is twice its height and one half of its length. If the volume of the hall is 1728 cu. Dm then find its dimensions.

Solution : Consider, Length of the hall = l

Breadth of the hall = b, Height of the hall = h, and volume of the hall = V

We have, the breadth of the hall (b) = 2h

$$\therefore \mathbf{h = \frac{b}{2}}$$

The breadth of a hall is one half of its length that means the

$$\therefore \textbf{Length of the hall } (\boldsymbol{l}) = \mathbf{2b}$$

The volume of the hall is 1728 cu.dm.

$$\textbf{Volume of the hall (V)} = \boldsymbol{l} \times \mathbf{b} \times \mathbf{h}$$

$$\therefore \mathbf{1728 = 2b \times b \times \frac{b}{2}}$$

$$\therefore \mathbf{1728 = b \times b \times b}$$

$$\therefore \mathbf{1728 = b^3}$$

$$\therefore \mathbf{(12)^3 = b^3}$$

$$\therefore \mathbf{b = 12\ dm.}$$

Convert decimal into meter

1 dm = 0.1 m

$$\therefore \mathbf{b = \frac{12}{10}\ m}$$

$$\therefore \mathbf{b = 1.2\ m}$$

∴ **Breadth of the hall (b) is 1.2 cm.**

Now, Height of the hall = (h) $= \frac{b}{2}$

$$= \frac{1.2}{2}$$

$$= 0.6 \text{ m}$$

∴ **The height of the hall is 0.6 m.**

Length of the hall $= l = 2b$

$$= 2 \times 1.2$$

$$= 2.4 \text{ m}$$

∴ **The length of the hall is 2.4 cm**

5. The side of the cube shaped wooden bookshelf is 0.4 m. How many books are stored in that book shelf with length 8 cm, breadth 4 cm and height 1 cm.

Answer : The side of bookshelf = 0.4 cm

$0.4 \times 100 = 40$ **cm ….. [1 m = 100 cm]**

Length of the book $(l) = 8$ **cm**

Breadth of the book (b)= 4 **cm**

Height of the book (h) = 1 cm

Volume of the bookshelf = $(\text{side})^3 = (40)^3$

$$= 40 \times 40 \times 40$$

$$= 64000\text{cm}^3$$

Volume of a one book = $l \times b \times h$

$$= 8 \times 4 \times 1$$

$$= 32 \text{ cm}^3$$

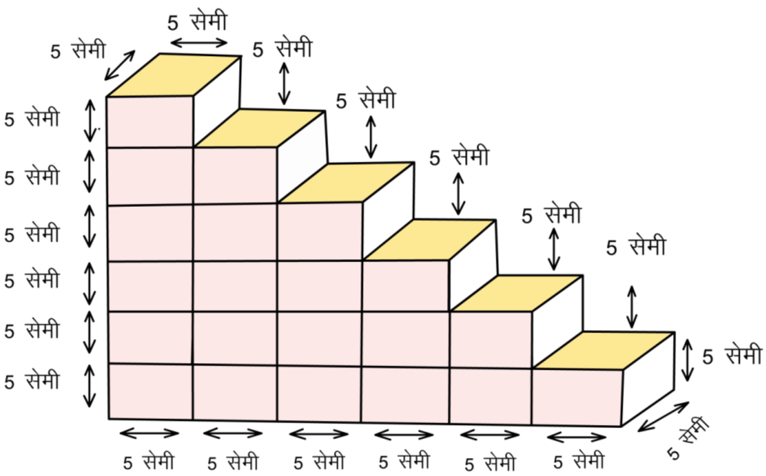
Number of the books= $\dfrac{\text{Volume of the bookshelf}}{\text{Volume of a one book}}$

$$= \frac{64000}{32}$$

$$= 2000$$

∴2000 book are stored in the wooden bookshelf.

6. In the adjacent figure, the edge of each cube is 5 cm. Find the volume of the given structure.



Solution : Edge of each cube = 5 cm

$\therefore$**Volume of each cube** $= (\text{Side})^3$

$= (5)^3$

$= 5 \times 5 \times 5$

$= 125$ **cu. cm**

The number of cubes = 21

$\therefore$ **Total volume of the structure** $=$ **Number of cubes** $\times$ **Volume of a cube**

$= 21 \times 125$

$= 2625$ **cu.cm.**

$\therefore$**The volume of the given structure is 2625 cu.cm.**

7. What is the length of solid cylinder 2 cm in diameter must be taken to recast the same volume into a hollow cylinder of external diameter 25 cm, 0. 25 cm thick and 15 cm long ?

Solution : External diameter of hollow cylinder = 25 cm

External radius of hollow cylinder (R) $= \frac{\text{diameter}}{2}$

$= \frac{25}{2} = 12.5$ **cm**

Thickness of hollow cylinder (t) = 0. 25 cm

∴Internal radius of cylinder = External radius of hollow cylinder − thickness of hollow cylinder

= 12. 5 −0. 25 = 12. 25 cm

Length of cylinder (h) = 15 cm

Volume of hollow cylinder = Volume of the out sided hollow cylinder−Volume of inner sided hollow cylinder.

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

∴Volume of hollow cylinder $= \pi h(R^2 - r^2)$

$$= \pi \times 15\,[(12.5)^2 - (12.25)^2]$$

$$= 15\pi\,[(12.5 + 12.25)\,(12.5 - 12.25)]$$

$$\ldots\ldots\ [\because\ a^2 - b^2 = (a+b)(a-b)]$$

$$= 15\pi\,[(24.75)(0.25)]$$

$$= 15\pi \times 6.1875\ \text{cm}^3 \qquad \ldots.\ (\text{I})$$

Now, diameter of solid cylinder = 2 cm

∴Radius of solid cylinder $= r_1 = \frac{\text{diameter}}{2}$

$$= \frac{2}{2} = 1\ \text{cm}$$

Let h_1 be the length of solid cylinder.

Volume of the solid cylinder $= \pi r_1^2 h_1$

$$= \pi \times (1)^2 \times (h_1)$$

$$= \pi h_1 \qquad \ldots\ldots \text{(II)}$$

A hollow cylinder is melted to formed solid cylinder with the same volume.

∴From equation (I) and (II)

$$\therefore \pi h_1 = 15\pi \times 6.1875$$

$$\therefore \frac{\pi h_1}{\pi} = 15 \times 6.1875$$

$\therefore h_1 = 92.8185$ **= 93 cm.**

∴The length of solid cylinder will be 93 cm.

8. The radius of the base of a circular cylinder is 7 cm and its height is 20 cm. Find :

(i) The volume of circular cylinder

(ii) The total surface area of circular cylinder.

Solution : Radius of the base of a circular

Cylinder (r) = 7 cm

Hight (h)= 20 cm

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

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

$$= 22 \times 7 \times 20$$

$$= 3080 \text{ cu.cm.}$$

∴The volume of a cylinder is 3080 cu. cm

(ii)Total surface area of a cylinder = $2\pi r\,(h + r)$

$$= 2 \times \frac{22}{7} \times 7\,(20 + 7)$$

$$= 2 \times 22 \times 27$$

$$= 1188 \text{ sq.cm}$$

∴The total surface of a cylinder is 1188 sq.cm.

9. The radius and height of a cylinder are in the ratio 3 : 2 and its volume is 19404 cm^3. Find its radius and height.

Solution : The radius and height of a cylinder are in the ratio 3 : 2

Suppose the radius be $3x$ and height be $2x$.

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

$$19404 = \frac{22}{7} \times (3x)^2 \times (2x)$$

$$= \frac{22}{7} \times 9x^2 \times 2x$$

$$= \frac{22 \times 18x^3}{7}$$

$$\therefore 19404 = \frac{396}{7} x^3$$

$$\therefore x^3 = \frac{19404 \times 7}{396}$$

$$= \frac{3234 \times 7}{66}$$

$$= \frac{539 \times 7}{11}$$

$$= 49 \times 7$$

$$\therefore x^3 = 7 \times 7 \times 7$$

$$\therefore x = 7 \text{ cm.}$$

$\therefore$ Radius of the cylinder $= 3x = 3 \times 7 = 21$ cm

Height of the cylinder $= 2x = 2 \times 7 = 14$ cm.

$\therefore$ Radius is 21 cm and height is 14 cm of the cylinder.

10. The radius of the base of a cylindrical drum is 154 cm. It has water upto 3 meters. Find the volume of rised water in kilo – litre if water is filled into that drum upto 4.5 meter.

Solution : Radius of the base of a cylindrical drum = 154 cm.

Initial level of water in the drum (h) = 3 cm

$= 3 \times 100$ **cm ….. (1m = 100 m)**

$\therefore$ **Volume of water** $= \pi r^2 h$

$$= \frac{22}{7} \times (154)^2 \times 3 \times 100$$

$$= \frac{22}{7} \times 154 \times 154 \times 3 \times 100$$

$$= 22 \times 22 \times 154 \times 3 \times 100$$

$$= 22360800 \text{ cm}^3$$

The level of water rised upto 4.5 cm.

Suppose it is h_1.

$\therefore$**Volume of rised water** $= \pi r^2 h_1$

But 4.5 m $= 4.5 \times 100$ **cm**

$$= \frac{22}{7} \times (154)^2 \times 4.5 \times 100$$

$$= \frac{22}{7} \times 154 \times 154 \times 4.5 \times 100$$

$$= 22 \times 22 \times 154 \times 4.5 \times 100$$

$$= 33541200 \text{ cm}^3$$

∴Volume of rised water = Volume of water upto the level 4. 5 m − Volume of water upto the level 3 m.

$$= 33541200 - 22360800$$

$$= 11180400 \text{ cu. cm}$$

Now convert cu. cm into litre,

1000 cu. cm = 1 litre

∴Volume of rised water = $\frac{11180400}{1000}$

$$= 11,180.4 \text{ litre}$$

But we have to find out the volume of rised water in

kilo – letre.

∴ Convert 11180.4 into kilo – letre,

1 kilo – letre = 1000 litre

$\therefore$ **Volume of rised water** $= \frac{11180.4}{1000}$ **kilo litre**

$$= \frac{11180.4 \times 10}{1000 \times 10} \text{ kilo – litre}$$

$$= \frac{111804}{10000} \text{ kilo litre}$$

$= 11.1804$ **kilo litre**

$\therefore$ **The volume of the rised water is 11.1804 kilo – litre.**

11. A wooden box including the lid has external dimensions 40 cm × 34 cm ×30 cm. If the wood is 1 cm thick, how many cm^3 of wood is used in it ?

Solution : The external dimensions of wooden box are

40 cm × 34 cm × 30 cm

$\therefore$ **Volume of the wooden box with external dimensions**

$= l \times b \times h$

$= 40 \times 34 \times 30$

$= 40800 cm^3$

The wood is 1 cm thick.

$\therefore$**The internal length of that wooden box** $= (40 - 2)$

$$= 38 \text{ cm}$$

The internal breadth $= (34 - 2) = 32$ cm.

The internal height $= (30 - 2) = 28$ cm.

$\therefore$Volume of the wooden box with internal dimensions

$$= l_1 \times b_1 \times h_1$$

$$= 38 \times 32 \times 28$$

$$= 34048 \text{ cm}^3$$

$\therefore$ Wood used for the box $=$ volume of the wooden box with external dimensions $-$ volume of the wooden box with internal dimensions.

$= 40800 - 34048 = 6752 \text{ cm}^3$

12. The length, breadth and height of a shop is 8 m, 3 m and 6 m respectively. The boxes of water bottles will keep in this shop. How many boxes of length 50 cm, breadth 20 cm, height 10 cm will fill the shop completely?

Solution : 1 m = 100 m

The length of shop = 8 m = 800 cm,

Breadth = 3m = 300 cm, height = 6 cm = 600 cm

$\therefore$Volume of shop $= l \times b \times h$

$$= 800 \times 300 \times 600 \text{ cm}^3$$

Length of a box 50 cm, breadth = 20 cm , height 10 cm

$\therefore$**Volume of a box** $= l_1 \times b_1 \times h_1$

$$= 50 \times 20 \times 10 \text{ cm}^3$$

$\therefore$**Number of boxes** $= \frac{\text{Volume of shop}}{\text{Volume of a box}}$

$$= \frac{800 \times 300 \times 600}{50 \times 20 \times 10}$$

$$= 800 \times 6 \times 3$$

$$= 14,400$$

$\therefore$ **14,400 boxes will fill the shop completely.**

13. A cube of side 6 cm is cut into cubes of length 1 cm. Find the area ratio between their surface areas.

Solution : Side of the big cube = 6 cm

Length of side of new cube = 1 cm

$\therefore$ **Volume of the big cube** $= (6)^3$

$$= 6 \times 6 \times 6$$

$$= 216 \text{ cm}^3$$

Volume of a new cube = $(l_1)^3 = (1)^3 = 1\text{cm}^3$

Number of new cubes = $\dfrac{\text{Volume of the big cube}}{\text{Volume of a new cube}}$

$$= \frac{216}{1}$$

$$= 216$$

Now, surface area of the big cube

$= 6l^2$

$= 6 \times (6)^2$

$= 6 \times 36\ \text{cm}^3$ **..... (I)**

Surface area of the new cube

$= 6l_1^2 \times 216$

$= 6(1)^2 \times 216$

$= 6 \times 216\ \text{cm}^3$ **….. (II)**

$\therefore$ **The ratio between the surface area of big cube and new cube**

$= \dfrac{6 \times 36}{6 \times 216}$ **….. [from (I) & (II)]**

$= \dfrac{1}{6}$

$\therefore$ The ratio between the surface areas of big cube and new cube is 1 : 6

14. If the each edge of a cube increases by 20 % , then find the percentage increase in its volume.

Solution : Suppose the each edge of cube be 100 units

$\therefore$ Volume of the cube $= (100)^3 = 100 \times 100 \times 100$

$$= 1000000 \text{ cm}^3$$

If each edge is increased by 20 %.

$\therefore$ New edge will be $100 + 20 = 120$ units

$\therefore$ Volume of the cube with new edge = $(120)^3$

$$= 120 \times 120 \times 120$$

$$= 1728000 \text{ Cubic units}$$

$\therefore$ Increase in volume of the cube = $1728000 - 1000000$

$$= 728000$$

$\therefore$ The percentage increase in volume of the cube

$$= \frac{728000}{1000000} \times 100$$

$$= \frac{728}{10}$$

$= 72.8$

$\therefore$ Percentage increase in volume of the cube will be 72. 8.

15. 3080 cm^3 of water is required to fill a cylindrical vessel completely and 2310 cm^3 of water is required to fill it upto 5 cm below the top. Find (i) radius of the vessel (ii) height of the vessel (iii) wetted surface area of the vessel when it is half filled with water.

Solution : Suppose r be the radius of the cylindrical vessel and h be its height.

Now, volume of cylindrical vessel = Volume of water filled in it.

$\therefore \pi r^2 h = 3080$

$\therefore \frac{22}{7} \times r^2 \times h = 3080$

$\therefore r^2 \times h = \frac{3080 \times 7}{22}$

$\therefore r^2 \times h = 140 \times 7$

$\therefore r^2 \times h = 980$ ..... (I)

Volume of cylindrical vessel of height 5 cm = Required water which is fill a cylindrical vessel completely $-$ Water is required to fill it upto 5 cm below the top.

$= 3080 - 2310 = 770$

$\therefore \pi r^2 h_1 = 770$

$\therefore \frac{22}{7} \times r^2 \times 5 = 770$

$\therefore r^2 = \frac{770 \times 7}{22 \times 5}$

$= \frac{70 \times 7}{2 \times 5}$

$= \frac{35 \times 7}{5}$

$\therefore r^2 = 7 \times 7$

$\therefore r = 7$ **cm**

$\therefore$ **The radius of the vessel is 7 cm.**

(ii) Substituting the value of $r = 7$ in equation (I),

$\therefore r^2 \times h = 980$

$\therefore (7)^2 \times h = 980$

$\therefore 49 \times h = 980$

$$\therefore \mathbf{h} = \frac{980}{49}$$

$$= \frac{140}{7}$$

$\therefore$ **h = 20 cm**

$\therefore$ **The height of the vessel is 20 cm.**

(iii) Let h_2 be the height of half a vessel.

$\therefore$ **Height of half a vessel $(h_2) = \frac{h}{2} = \frac{20}{2} = 10$ cm**

$\therefore$ **Wetted surface area of the vessel when it is half - filled with water = curved surface area of vessel +**

$$= 2\pi r h_2 + \pi r^2$$

$$= \left[2 \times \frac{22}{7} \times 7 \times 10\right] + \left[\frac{22}{7} \times 7 \times 7\right]$$

$$= [2 \times 22 \times 10] + [22 \times 7]$$

$$= 440 + 154$$

$$= 594 \text{ sq.cm}$$

$\therefore$ **The wetted surface area of the vessel when it is half - filled with water is 594 sq.cm.**

16. A cylindrical water tank of diameter 2.8 m and height 4.2 m is being fed by a pipe of diameter 7 cm through which water flows at the rate of 2 m/s. Calculate in minutes, the time it takes to fill the tank.

Solution : Diameter of cylindrical tank = 2.8 m

$\therefore$ **Radius of the cylindrical tank** $= \frac{\text{Diameter}}{2}$

$= \frac{2.8}{2}$

$= 1.4 \text{ m}$

Height of the cylindrical tank = 4.2 m

Volume of water filled in tank $= \pi r^2 h$

$= \frac{22}{7} \times 1.4 \times 1.4 \times 4.2$

$= 22 \times 0.2 \times 1.4 \times 4.225.872 \text{ m}^3$ **..... (I)**

Diameter of pipe = 7 cm

$\therefore$ **Radius of pipe** $= \frac{\text{Diameter}}{2} = \frac{7}{2}$ **cm.**

Suppose h_1 **be the length of water in pipe.**

$\therefore$**Volume of the pipe with water** $= \pi r_1^2 h_1$

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times h_1$$

$$= \frac{77}{2} h_1 \ cm^3 \quad ...... (II)$$

∴ From the equation (I) & (II) Volume of water filled in tank = Volume of pipe with water

$$\therefore \ 25.872 \ m^3 = \frac{77}{2} h_1 \ cm^3$$

Convert m^3 into cm^3

$$1m^3 = 100^3 cm^3$$

$$\therefore 25.872 \times 100^3 \ cm^3 = \frac{77}{2} h_1 cm^3$$

$$\therefore h_1 = \frac{25.872 \times 100^3 \times 2}{77}$$

$$= \frac{25.872 \times 100 \times 100 \times 100 \times 2}{77}$$

$$= \frac{3.696 \times 100 \times 100 \times 100 \times 2}{11}$$

$$= 0.336 \times 100 \times 100 \times 100 \times 2$$

$$= 0.672 \times 100 \times 100 \times 100$$

$$= 67200 \ cm^3$$

But the water flows at the speed of 2 m/s.

$\therefore$ Convert 672000 cm^3 into meter.

1 m = 100 cm

$\therefore h_1 = \frac{672000}{100}$

$\therefore h_1 = 6720$ m.

$\therefore$ The time taken at the speed of 2 m/s .

$= \frac{6720}{60 \times 2}$ ..... [1 minutes = 60 seconds]

$= \frac{112}{2}$

$= 56$ minutes

$\therefore$ 56 minutes are required to fill the water tank completely.

17. A diameter of the base of a cylindrical drum is 84 cm. The drum holds water if a block of metal 44 cm long, 42 cm wide and 21 cm high is submerged into the water. Find the rise in the level of water when the metal block is completely submerged.

Solution : Diameter of the base of a cylindrical drum

= 84 cm

$\therefore$ **Radius of the base of a cylindrical drum** $= \frac{\text{diameter}}{2}$

$= \frac{84}{2}$

$= 42$ **cm**

Length of a metal block = 44 cm, breadth = 42 cm,

height = 21 cm

$\therefore$ **Volume of the metal block** $= l \times b \times h$

$= 44 \times 42 \times 21$ **..... (I)**

Suppose h_1 **be the hight of water in the drum.**

$\therefore$ **Volume of the water in the drum**

$= \pi r_1^2 h_1$

$= \frac{22}{7} \times 42 \times 42 \times h_1$

$= 22 \times 6 \times 42 \times h_1$ **..... (II)**

From equation (I) and (II),

Volume of the metal block = Volume of the water in the drum.

$\therefore \ 44 \times 42 \times 21 = 22 \times 6 \times 42 \times h_1$

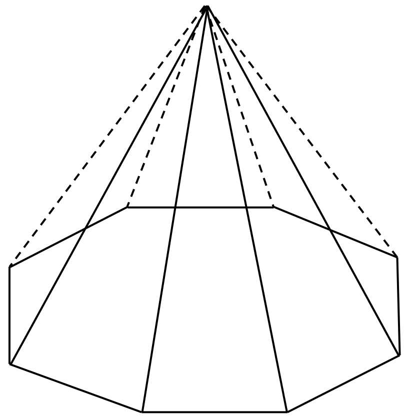
$$\therefore h_1 = \frac{44 \times 42 \times 21}{22 \times 6 \times 42}$$

$\therefore h_1 = 7$ cm.

∴ **The level of water in the drum will be rised by 7 cm.**

18. Draw octagonal pyramid count faces (F) , vertices (V) and edges (E) and verify Euler's formula.

Solution :



The octagonal pyramid have faces (F) = 9,vertices (V) = 9, edges (E) = 24

Euler's Formula $= V + F \quad = E + 2$

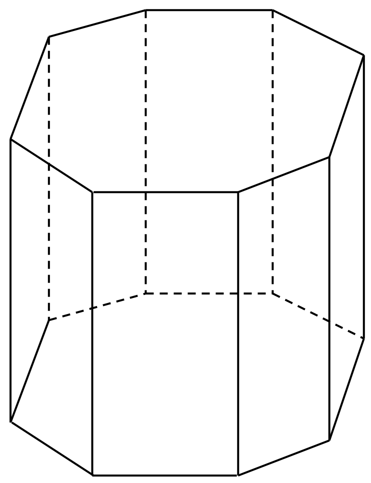
$$= 9 + 9 = 16 + 2$$

$$18 = 18 \quad \text{..... (I)}$$

∴ **From (I) Euler's formula can be verified.**

19. Draw octagonal prism. Count faces (F), Vertices (V) and edges (E) and verify Euler 's formula.

Solution :



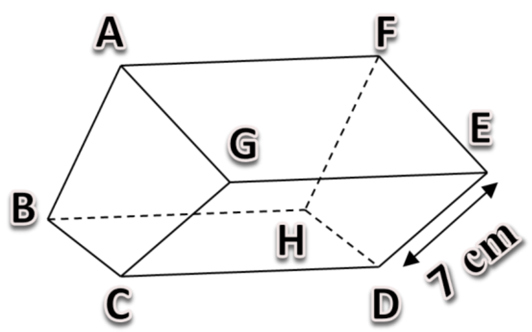
The octagonal prism have faces (F) = 10 ,vertices (V) = 16 & edges (E) = 24

Euler's formula = $V + F = E + 2$

$= 16 + 10 = 24 + 2$

$\therefore$ **From (I) Euler's formula can be verified.**

20. In the adjacent figure, A (BCDH) = 45 sq. cm, l **(DE) = 7 cm**



Solution :

A (BCDH) = area of base = 45 sq.cm

l (DE) = height = 7 cm.

Volume of given diagram $= 45 \times 7$

$$= 315\ \text{cm}^3$$

$\therefore$ Volume of given diagram is 315 cm^3.

21. The radius of the first cylinder is 3 cm, its height is 4 cm and the radius of the second cylinder is 2 cm, its height is 9 cm then,

(I) Find their volume & write conclusion.

(II) Find their curved surface area & write conclusion.

Solution : (I) The radius of the first cylinder

(r) = 3 cm and height (h) = 4 cm

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

$$= \pi \times 9 \times 4$$

$$= 36\pi \qquad \text{...... (I)}$$

Radius of the second cylinder $(r_1) = 2$ cm

and height $(h_1) = 9$ cm

Volume of the second cylinder $= \pi r_1^2 h_1$

$$= \pi \times 4 \times 9$$

$$= 36\pi \qquad \text{..... (II)}$$

Conclusion :

∴ From (I) and (II) the volume of the both cylinders are equal.

(II) Radius of the first cylinder (r) = 3 cm and its height (h) = 4 cm

∴ Curved surface area of first cylinder $= 2\pi rh$

$$= 2 \times \pi \times 3 \times 4$$

$$= 24\pi \qquad \text{..... (iii)}$$

Curved surface area of the second cylinder $= 2\pi r_1 h_1$

$$= 2 \times \pi \times 2 \times 9$$

$$= 36\pi \qquad \text{...... (iv)}$$

Conclusion :

∴ From (iii) and (iv), the curved surface area of both cylinders are different.

22. A hall is 70 m long, 25 m wide and 18 m high. How many persons can be accommodated in a hall if each person requires 90 cubic metres of air. To find that complete the following activity :

Length of hall = $\boxed{}$ **m, breadth =** $\boxed{}$ **m, height =** $\boxed{}$ **m**

Volume of the hall = Length × Breadth × Height

$$= \boxed{} \times \boxed{} \times \boxed{}$$

Each person requires 90 cubic metres of air.

$$\textbf{Number of persons} = \frac{\text{Volume of the hall}}{}$$

$$= \frac{\boxed{} \times \boxed{} \times \boxed{}}{}$$

$$= \boxed{}$$

$\therefore$ $\boxed{}$ **Persons can be accommodated in the hall.**

Solution :

Length of hall = $\boxed{70}$ **m, breadth =** $\boxed{25}$ **m, height =** $\boxed{18}$ **m**

Volume of the hall = Length × Breadth × Height

$$= \boxed{70} \times \boxed{25} \times \boxed{18}$$

Each person requires 90 cubic meters of air.

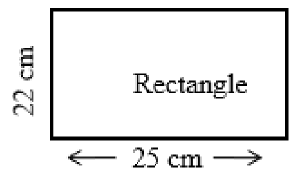
$$\therefore \text{Number of persons} = \frac{\text{Volume of the hall}}{\text{Volume of the required air of each person}}$$

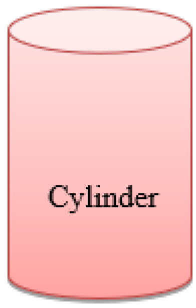
$$= \frac{\boxed{70} \times \boxed{25} \times \boxed{18}}{90}$$

$$= \boxed{350}$$

$\therefore$ $\boxed{350}$ **Persons can be accommodated in the hall.**

23. A rectangular sheet of paper of length 25 cm and breadth 22 cm is rolled along its length, find the curved surface area of new formed shape. Complete the following activity :





When a rectangular sheet is rolled along its length then ..... shape formed.

Length of a rectangle = $\boxed{}$ **cm,**

Breadth of a rectangle = $\square$ cm

Circumference of the base of the cylinder = length of the rectangle.

$2\pi r = \square$ **cm.**

$\therefore\ r = \frac{1}{2} \times \square \times \square$

$\therefore\ r = \square$ **cm.**

Now, height of the cylinder = Breadth of the rectangle

$\therefore\ h = \square$ **cm.**

Curved surface area of the cylinder formed

$= 2 \times \square$ **.... (Formula)**

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

$= \square \times 22$

$= \square$ **sq.cm**

$\therefore$ **Curved surface area of the cylinder formed is $\square$ sq.m.**

Solution :

When a rectangular sheet is rolled along its length then ..... shape formed.

Length of a rectangle = $\boxed{25}$ **cm,**

Breadth of a rectangle = $\boxed{22}$ **cm**

Circumference of the base of the cylinder = length of the rectangle.

$2\pi r = \boxed{25}$ **cm.**

$\therefore\ r = \frac{1}{2} \times \boxed{\frac{7}{22}} \times \boxed{25}$

$\therefore\ r = \boxed{\frac{175}{44}}$ **cm.**

Now, height of the cylinder = Breadth of the rectangle

$\therefore\ h = \boxed{22}$ **cm.**

Curved surface area of the cylinder formed $= 2 \times \boxed{\pi rh}$

.... (Formula)

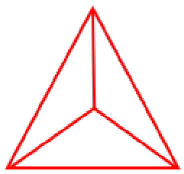
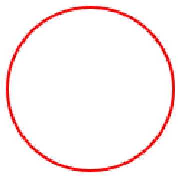
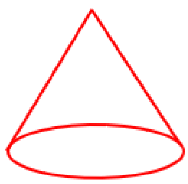
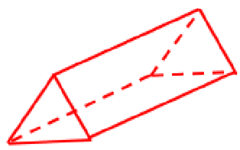
$= 2 \times \frac{22}{7} \times \boxed{\frac{175}{44}} \times \boxed{22}$

$= \boxed{25} \times 22$

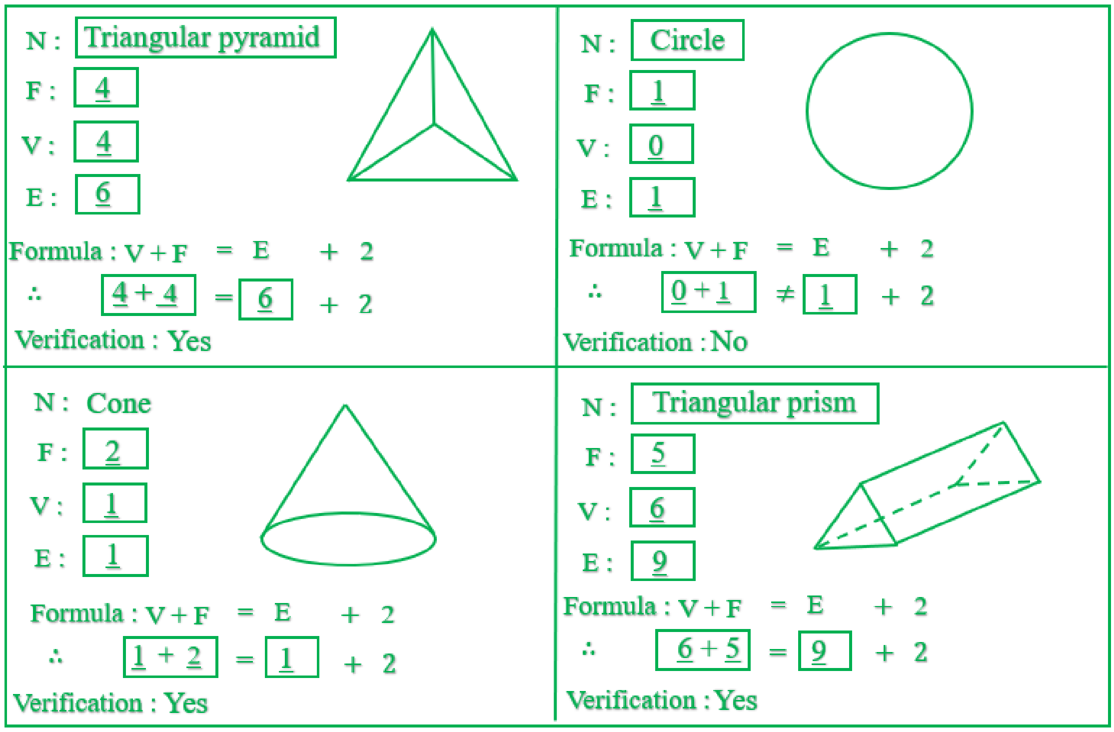
$= \boxed{550}$ sq.cm

∴ 550 sq. cm is the curved surface area of the cylinder formed.

24. Count and write the N = Name of the figure, F = Faces, V = vertices and E = Edges of the following figures and complete the table. From the table verify Euler's formula.

N : ☐ F : ☐ V : ☐ E : ☐  Formula : V + F = E + 2 ∴ ☐ = ☐ + 2 Verification : ………..	N : ☐ F : ☐ V : ☐ E : ☐  Formula : V + F = E + 2 ∴ ☐ = ☐ + 2 Verification : ………..
N : शंकू F : ☐ V : ☐ E : ☐  Formula : V + F = E + 2 ∴ ☐ = ☐ + 2 Verification : ………..	N : ☐ F : ☐ V : ☐ E : ☐  Formula : V + F = E + 2 ∴ ☐ = ☐ + 2 Verification : ………..

Solution :



25. Weather the following statements are true or false.

1. The measure of the space occupied by a solid is called the surface area of the solid.

Ans : False, the measure of the space occupied by a solid is called the volume of the solid.

2. Space occupied by a liquid in the container is its volume.

Ans : True

3. The volume of water filled in a cube of side 1 cm is 1 litre.

Ans : False, the volume of water filled in a cube of side 1 cm is 1 ml.

4. A diagram whose length, breadth and height are all equal is called a cuboid.

Ans : False, A diagram whose length, breadth and height are all equal is called a cube.

5. The upper and the lower surface of the closed cylinder is circular.

Ans : True

6. If the edge of a cube is doubled then volume is nine times of the original volume.

Ans : False, If the edge of a cube is doubled then its volume is 8^{th} times of the original volume.

7. If the edge of the cube become tripled then its volume is 27 times of the original volume.

Ans : True.

8. The surface area of two cubes are equal.

Ans : True

9. The sruface area of the two cuboids are equal.

Ans : False, A cuboid has rectangular faces so the surface areas of opposite faces of cuboid are same.

10. Two cuboids with equal volume will always have different surface area.

Ans : True.

26. Match the following pairs.

A.

Group 'A'	Group 'B'
1) Total surface area of a cuboid	(a) $2\pi r\,(h + r)$
2) Total surface area of a cube	(b) $(\text{side})^3$
3) Volume of the cube	(c) $2\pi rh$
4) Volume of the cuboid	(d) $V + F = E + 2$
5) Curved surface area of cylinder	(e) $6l^2$
6) Total surface area of cylinder	(f) length $\times$ breadth $\times$ height
7) Volume of cylinder	(g) $2\,(lb \times bh \times lh)$
8) Euler's formula	(h) $\pi r^2 h$

Ans :

Group 'A'	Group 'B'
1) Total surface area of a cuboid	(g) $2\,(lb \times bh \times lh)$
2) Total surface area of a cube	(e) $6l^2$
3) Volume of the cube	(b) $(\text{side})^3$
4) Volume of the cuboid	(f) length $\times$ breadth $\times$ height
5) Curved surface area of cylinder	(c) $2\pi rh$
6)Total surface area of cylinder	(a) $2\pi r\,(h + r)$
7) Volume of cylinder	(h) $\pi r^2 h$
8) Euler's formula	(d) $V + F = E + 2$

B.

1) 1 cubic meter	**(a) 1 mili- litre**
2) 1 litre	**(b) 1 cubic meter**
3) 1000 litres	**(c) 1000000 cubic cm**
4) 1 cubic cm	**(d) 1 cubic dcm**

Ans :

1) 1 cubic meter	**(c) 1000000 cubic cm**
2)1 litre	**(d) 1 cubic dcm**
3) 1000 litres	**(b) 1 cubic meter**
4) 1 cubic cm	**(a) 1 milliliter**

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