VIPIN KAUSHIK ASOSE SURAJMAL VIHAR

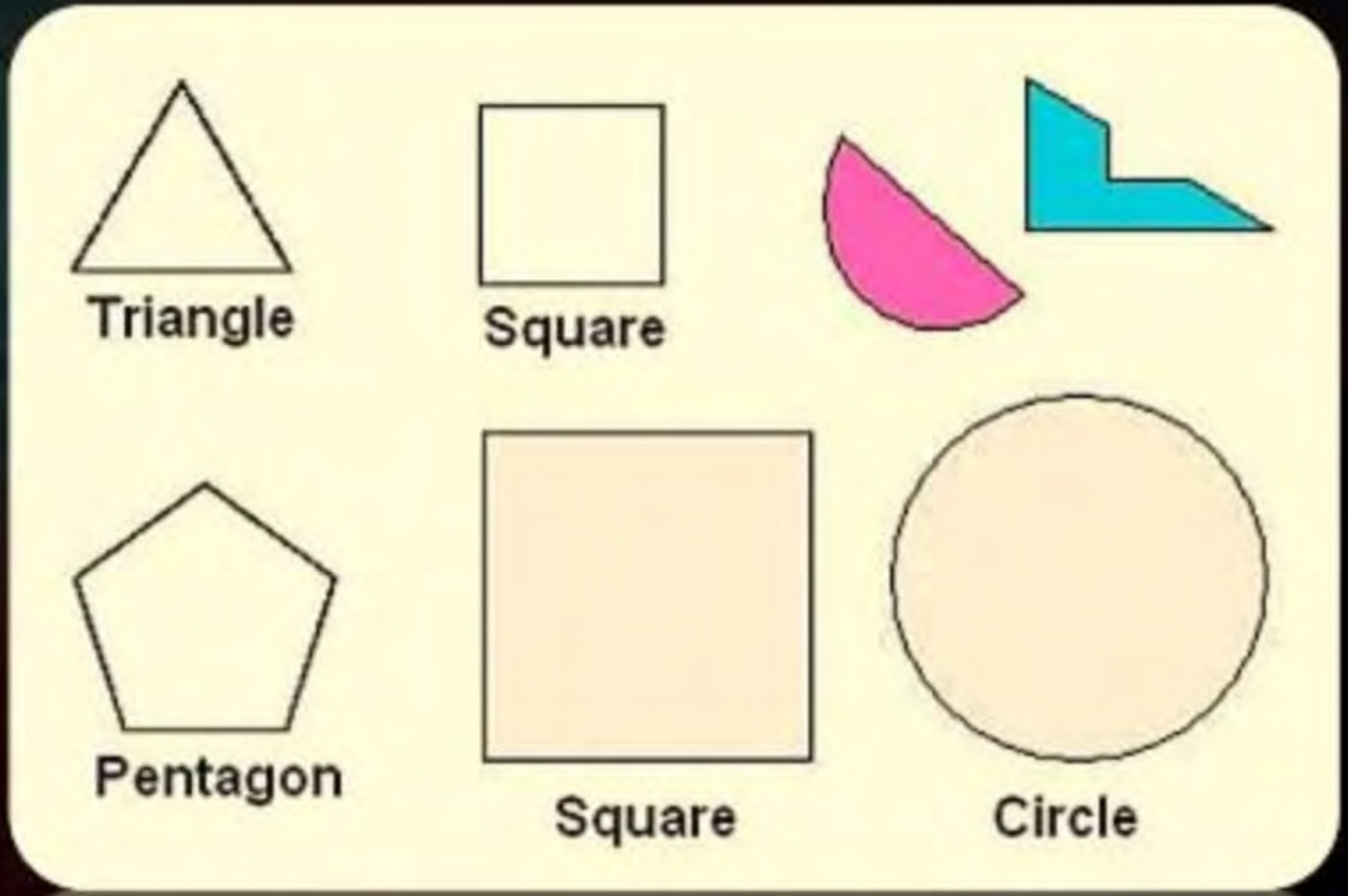
- **Subject -** Mathematics
- **Chapter –** Surface Areas and Volumes

Today's Targets

1. Complete Chapter
2. Analytical Approach
3. Tricks for memorising formulas

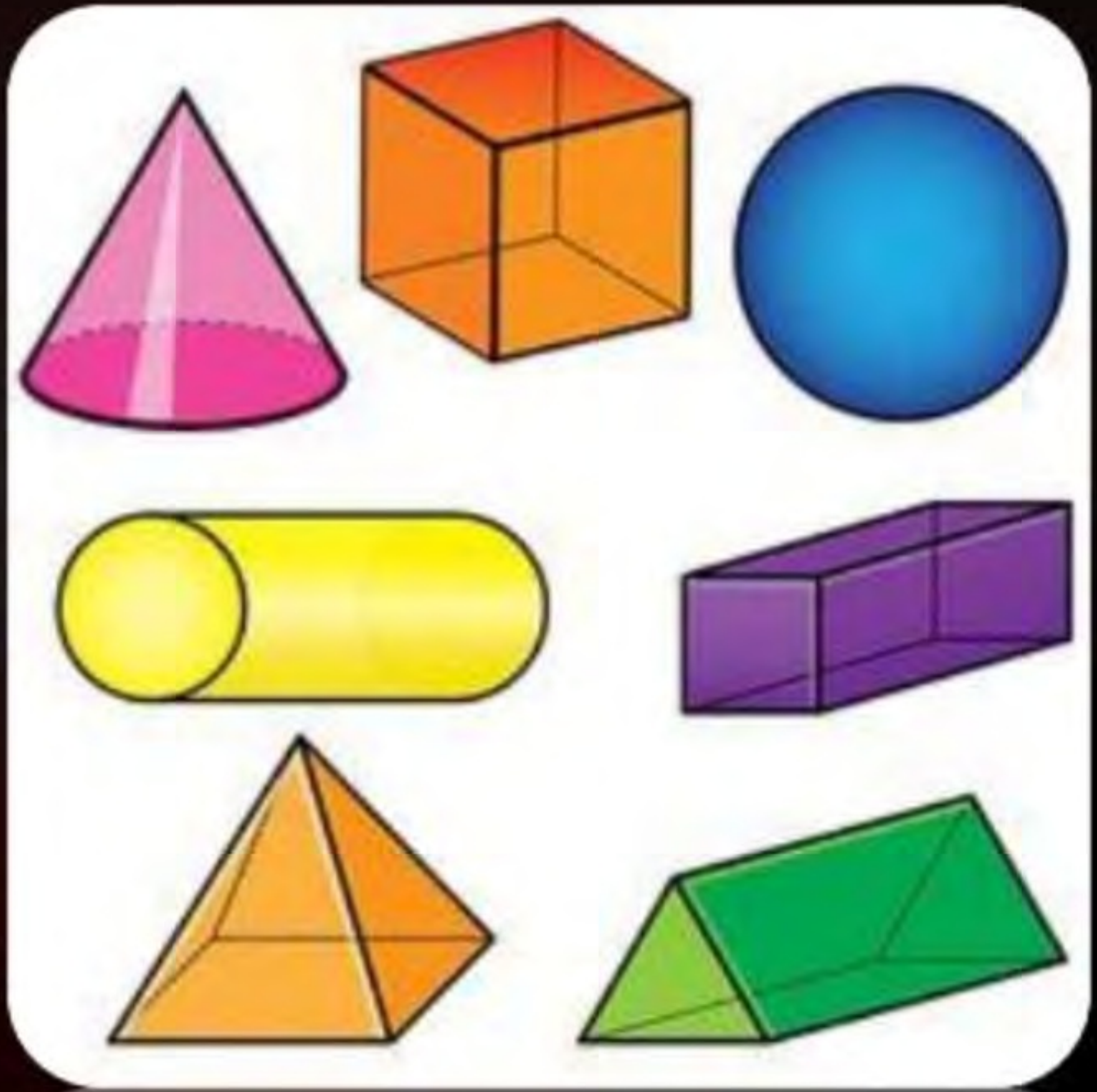
Plane Figures

Plane figures are two-dimensional surfaces that have no height or thickness. A few examples of plane figures are square, rectangle, circle and triangle.



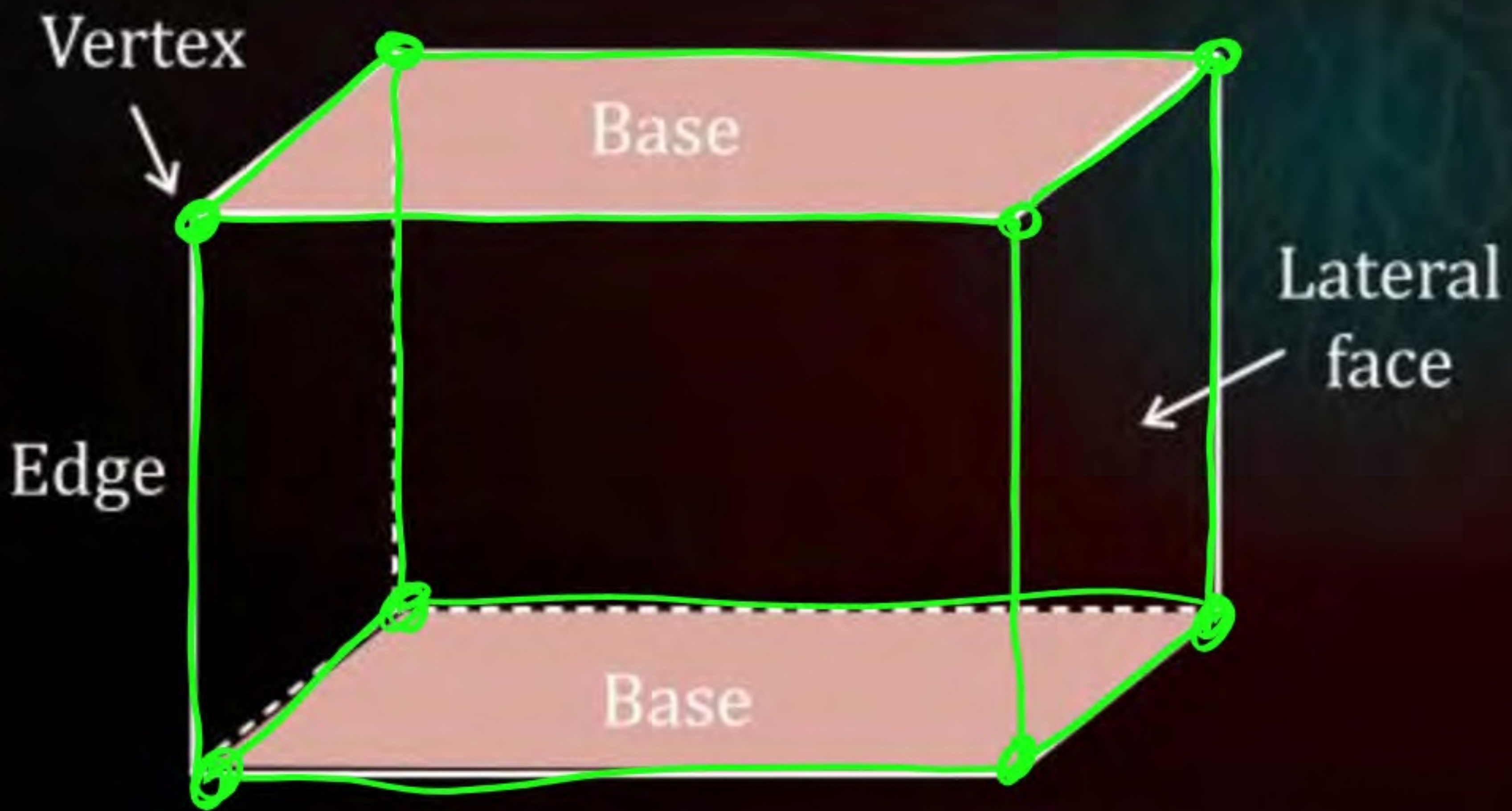
Solid Figures

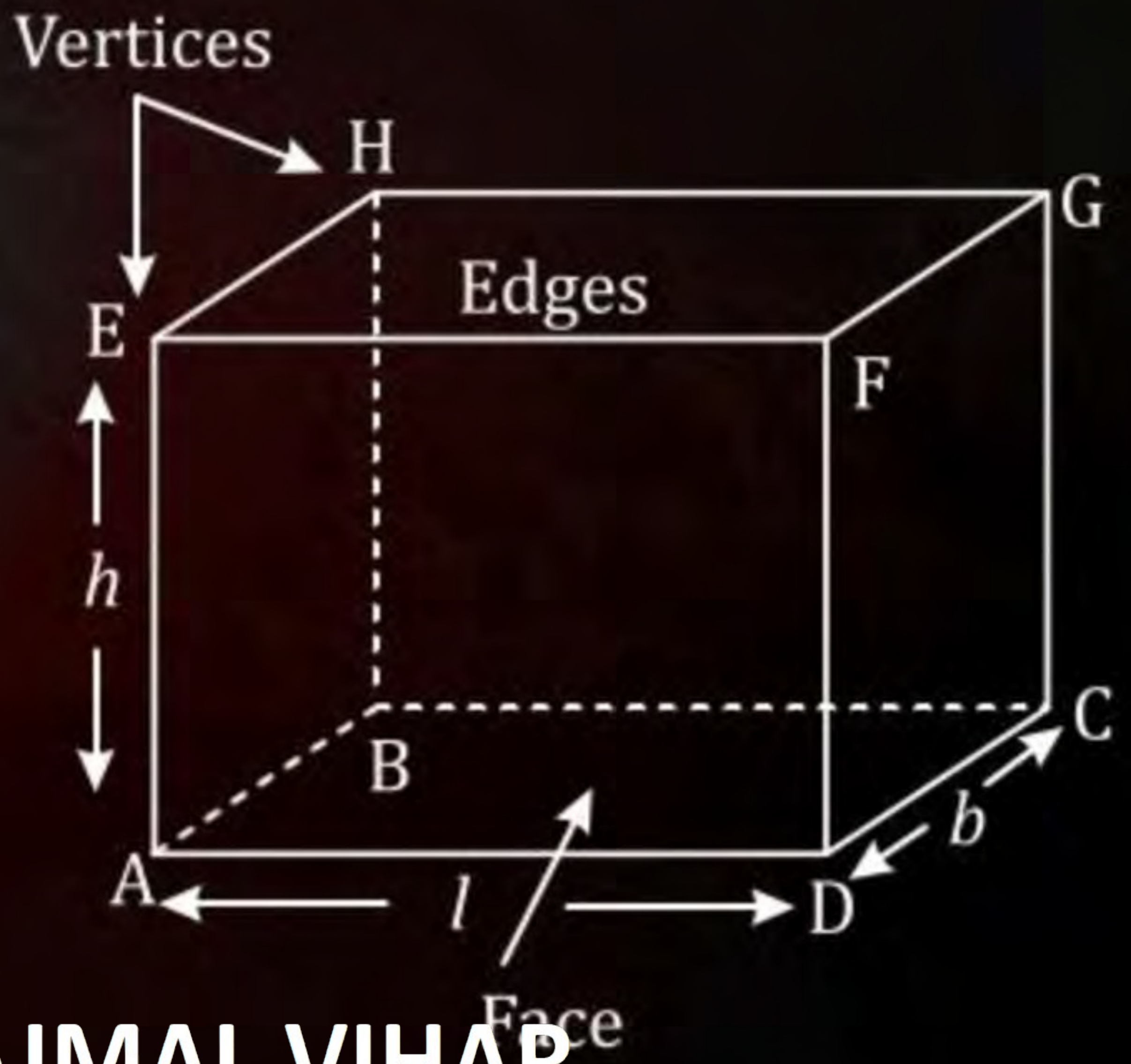
A solid figure is any three-dimensional object or shape. An object or shape that has measurements for length, width, and height is three-dimensional. Since solid figures have three dimensions, this means they occupy space. Any object that occupies space also has a volume measurement. The volume of a solid figure tells how much space that figure takes up.



Cuboid

A cuboid is a solid (3-D Shape) bounded by six rectangular plane surfaces, twelve edges and eight vertices. . E.g. match box, brick, box, etc., are cuboid.





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Properties of Cuboid

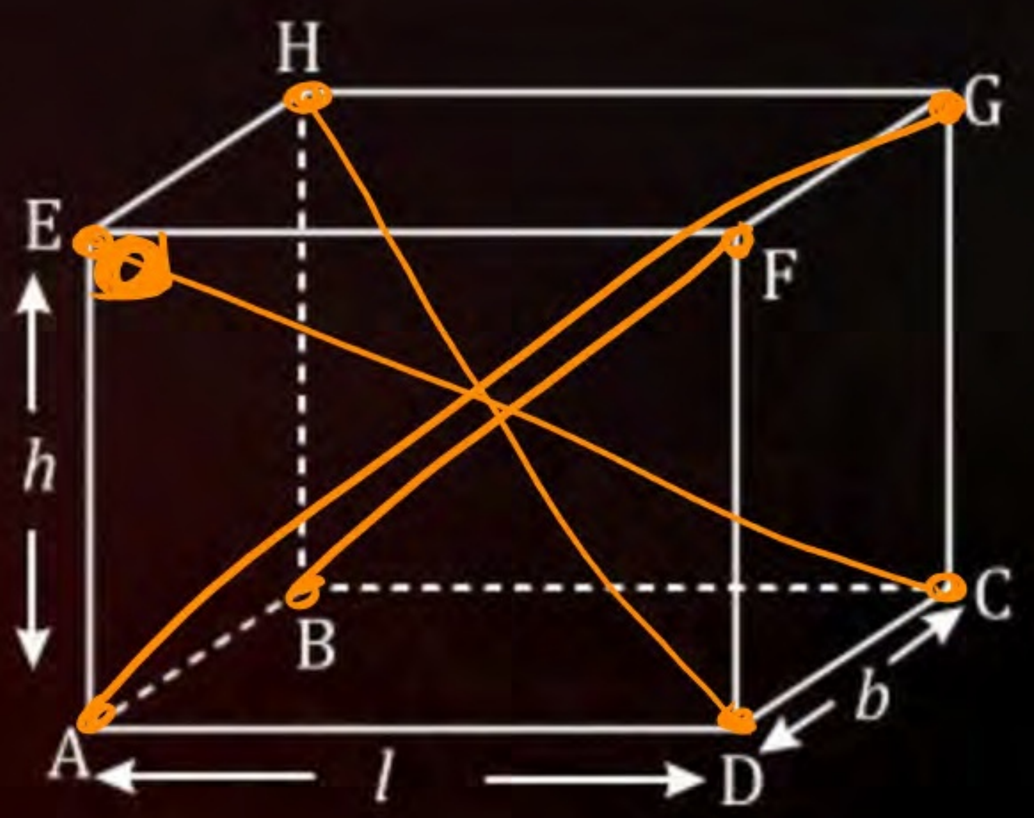
(i) In a cuboid, there are 6 faces, 12 edges and 8 corners *(four at bottom and four at top face)* which are called vertices.

(ii) Opposite faces of a cuboid are equal and parallel.

(iii) The line segment joining the opposite vertices is called the diagonal of a cuboid.

(iv) There are four diagonals in a cuboid which are equal in length.

(v) Angles formed at the vertices of the cuboid are all 90°



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Surface Area of a Cuboid

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

(i) Total Surface Area

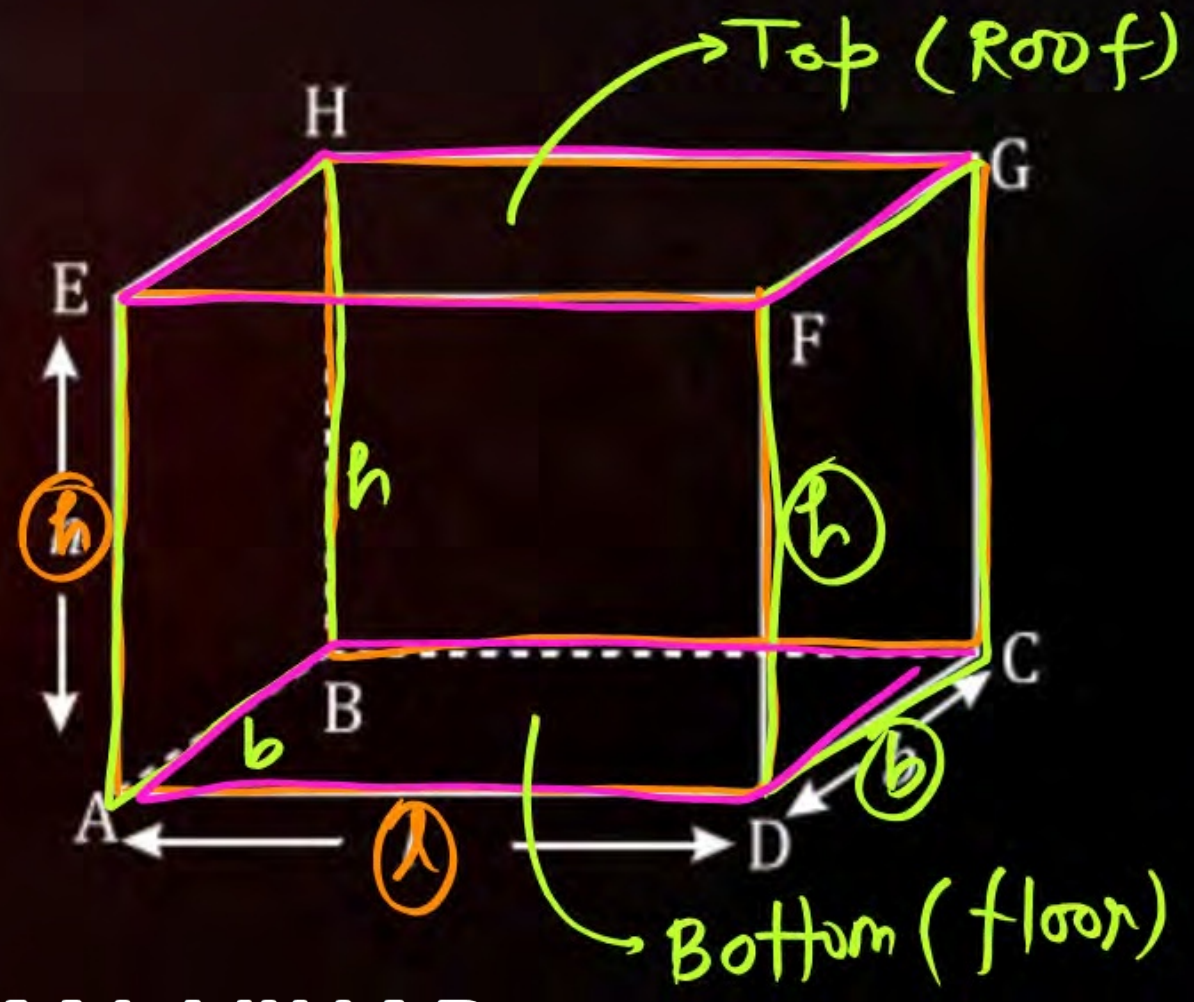
Surface Area (SA) or Total Surface Area (TSA) of the cuboid

= Sum of areas of six rectangle faces.

=

$$= \boxed{2(l \times b) + 2(b \times h) + 2(h \times l)}$$

$$= \boxed{2[lb + bh + hl]} \quad ***$$



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Surface Area of a Cuboid

(ii) Lateral Surface Area :

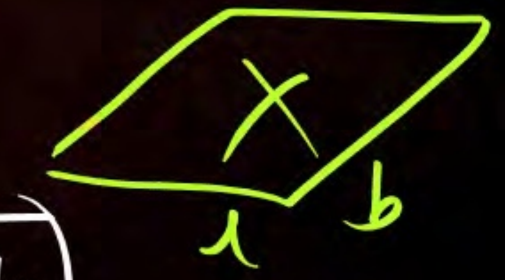
(vertical faces)
दिवार (wall)

If out of the six faces of a cuboid, we do not include the bottom and top faces, then the area of remaining four faces is called the lateral surface area of the cuboid.

So, Lateral surface area = Sum of area of four rectangular faces excluded the top and bottom faces

$$= 2(bh) + 2(hl)$$

$$= \underbrace{\boxed{2(l+b)}}_{\text{Bottom ka perimeter}}h = \boxed{\text{Base perimeter} \times h}$$



Surface Area of a Cuboid

Lateral surface area of a cuboid Or **Lateral surface area of a cuboid**

= $\boxed{\text{(Perimeter of the base) x Height}}$

$= 2(bh) + 2(hl)$

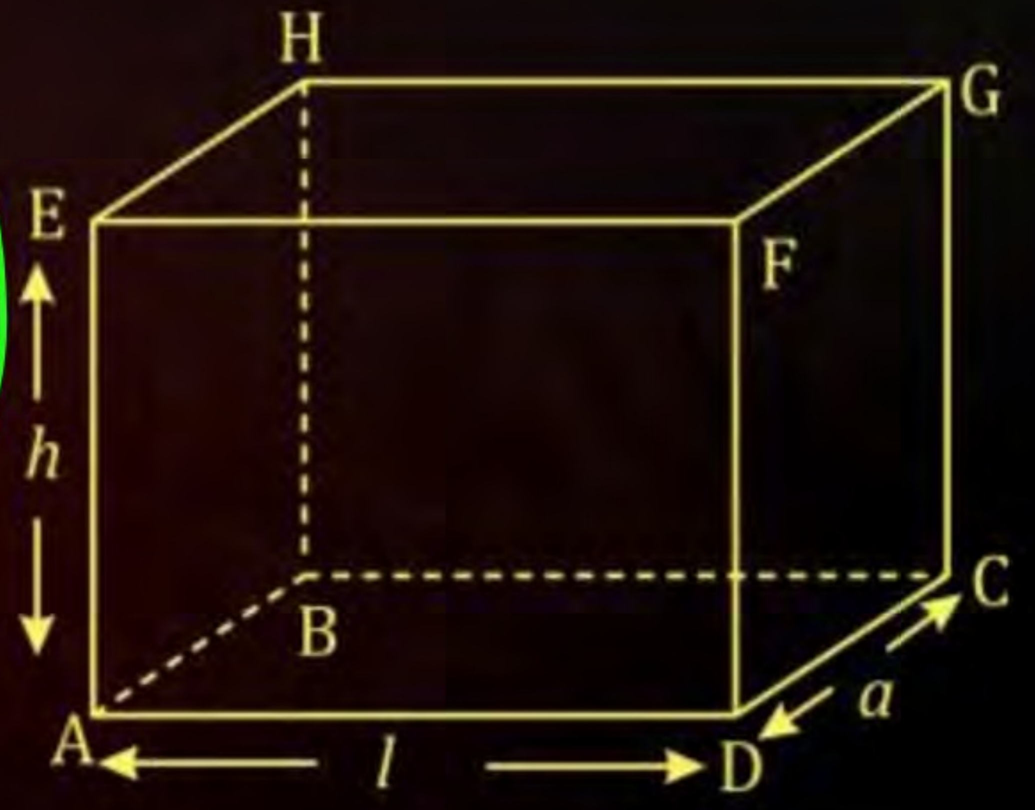
$= \boxed{2(l+b) \times h}$

$2(l \times b)$

Top & bottom

↓

Ignore

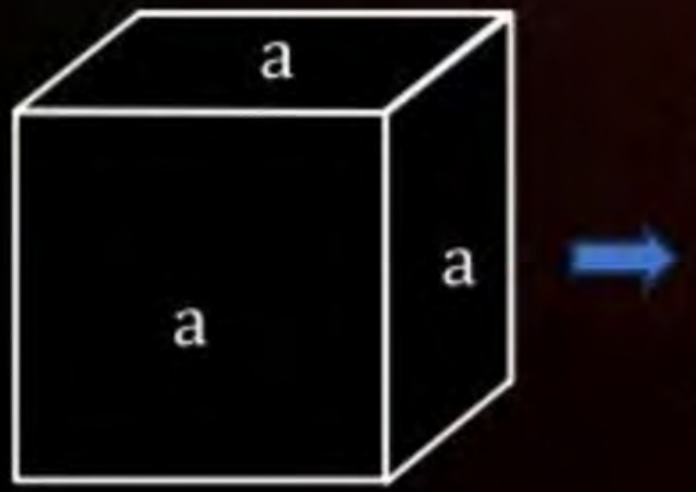


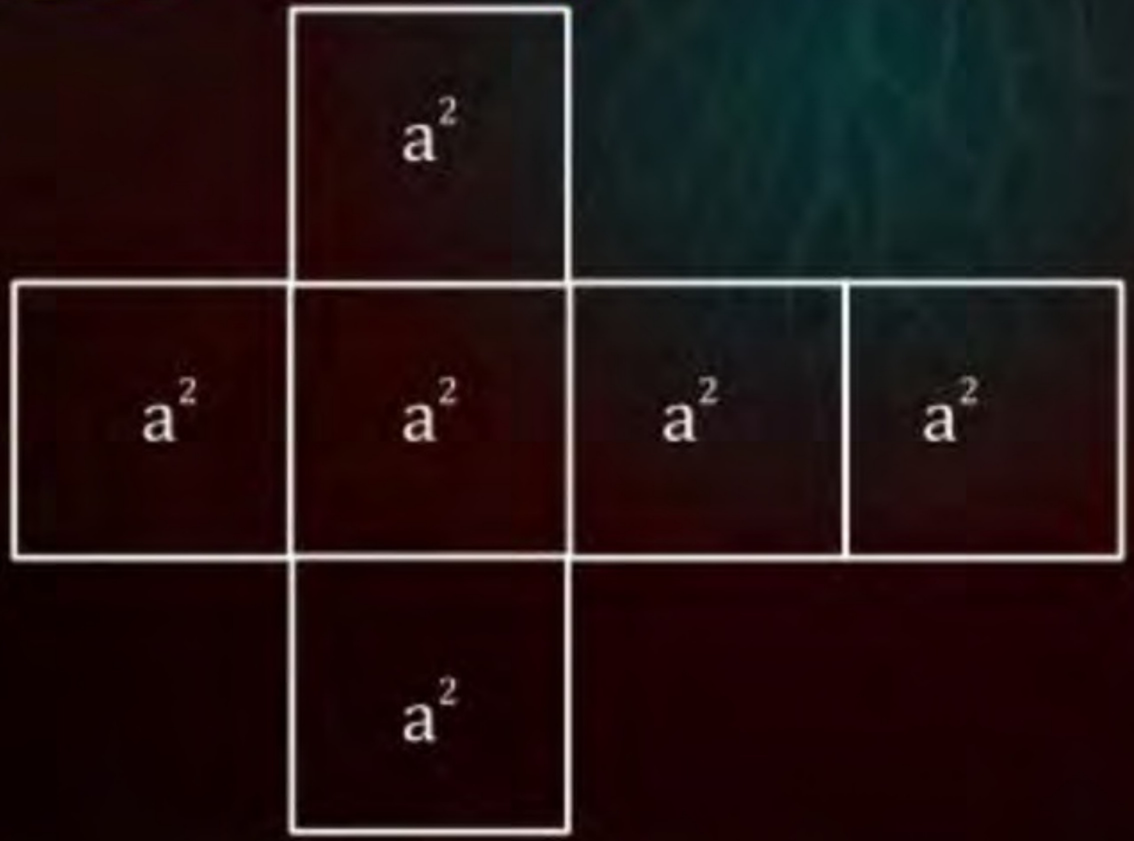
(iii) **Diagonal of a cuboid** = $\boxed{\sqrt{l^2 + b^2 + h^2}}$ units

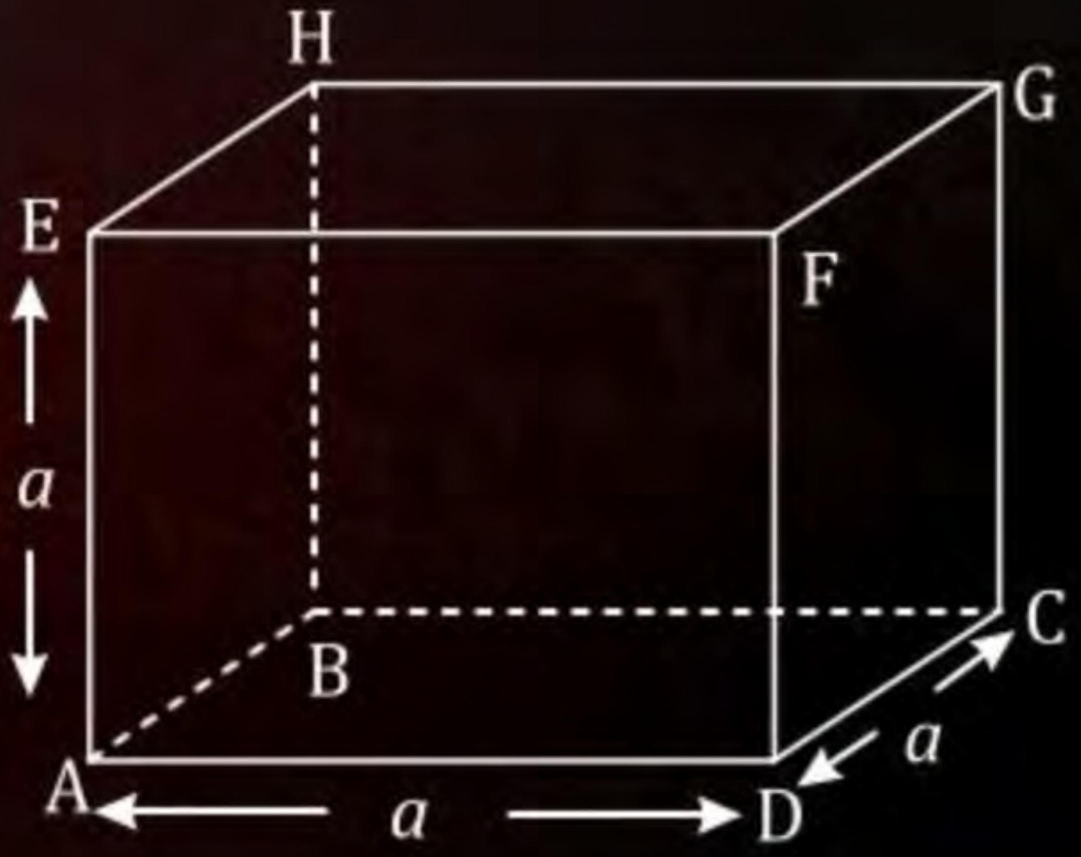
Cube

A cube is a 3D shape that has six faces, twelve edges and eight vertices. Each of its faces is a square. A cuboid whose length, breadth and height all are equal, is called a cube. e.g. Ice cubes, sugar cubes, dice are in cubical form.

$\boxed{l = b = h = \text{'}a\text{'}}$ (let's say)







Properties of Cube

(i) In a cube, there are 6 faces, 12 edges and 8 corners. (four at bottom and four at top face) which are called vertices.

(ii) It has all its faces in a square shape.

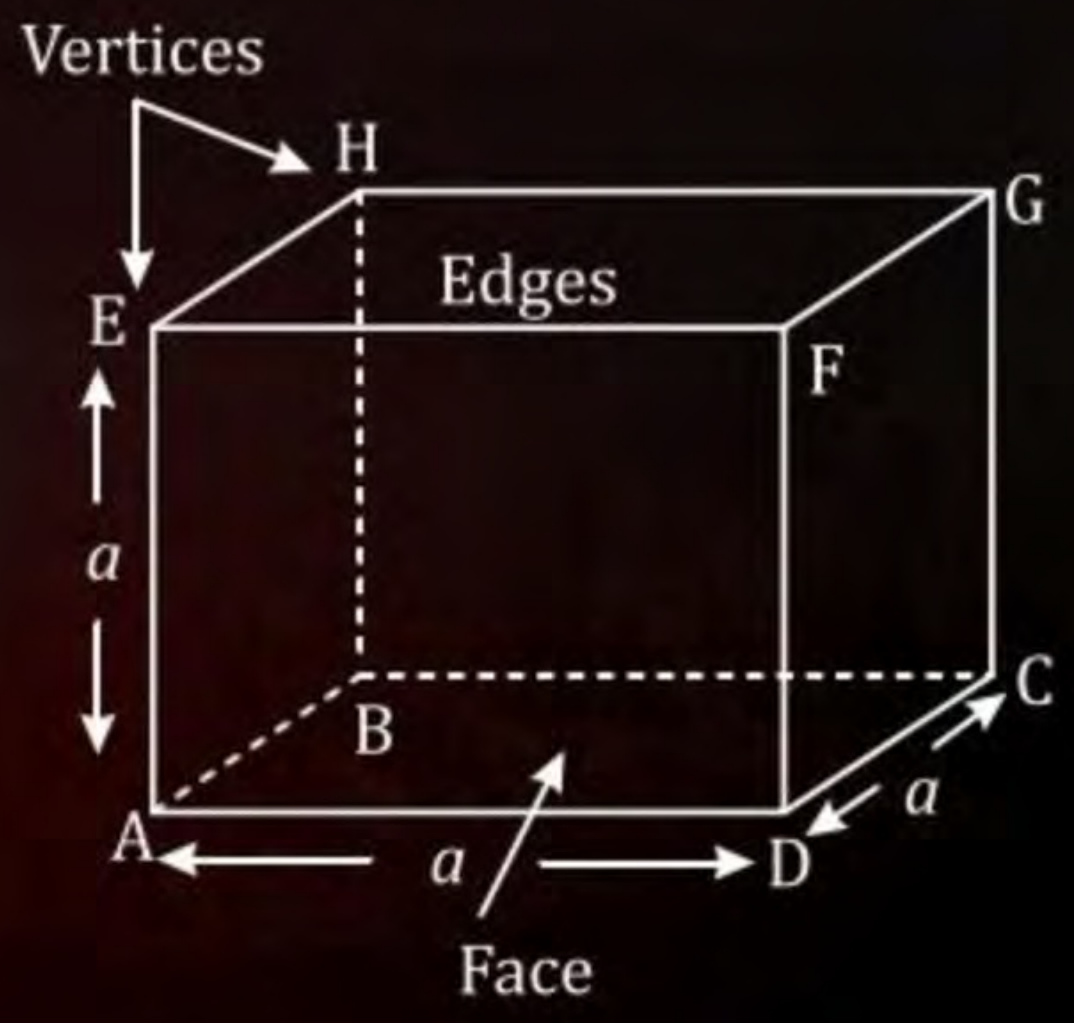
(iii) All the faces or sides have equal dimensions.

(iv) The plane angles of the cube are the right angle.

(v) Each of the faces meets the other four faces.

(vi) Each of the vertices meets the three faces and three edges.

(vii) The edges opposite to each other are parallel.



Surface Area of a cube

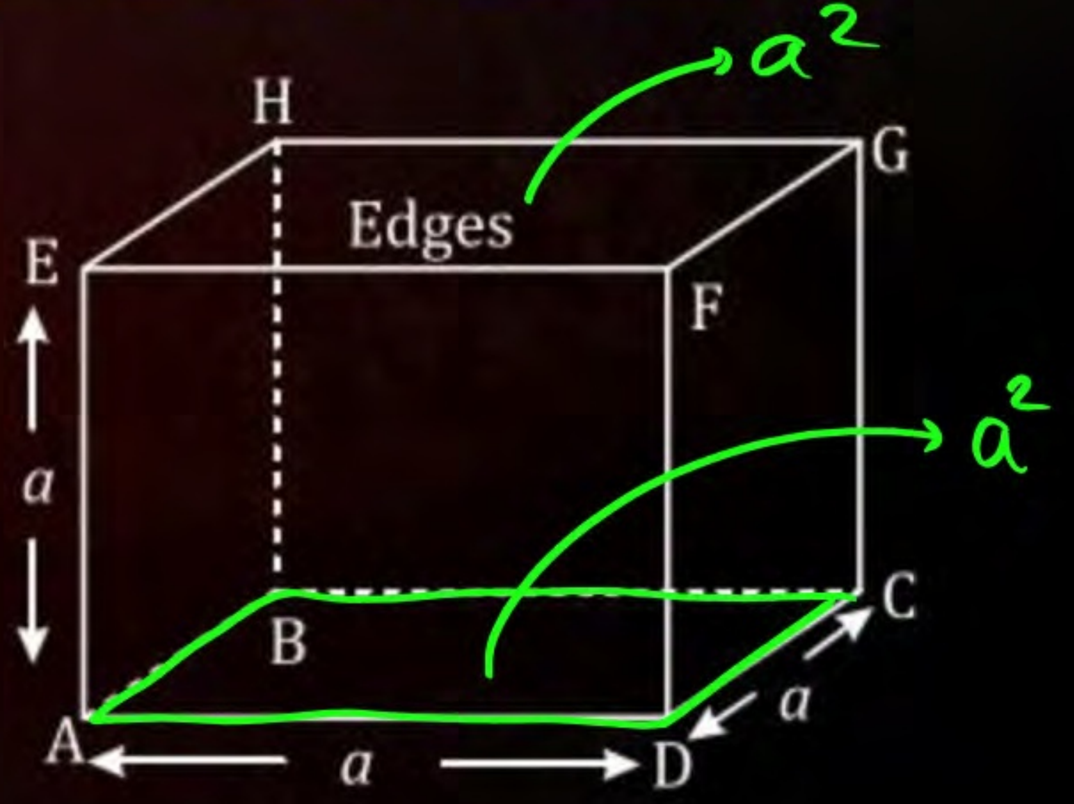
Let each edge of the cube be '*a*' units. Then,

(i) **Total surface area of the cube** = Sum of areas of six faces.

$= \boxed{6a^2}$

(ii) **Lateral surface area of the cube** = Sum of area of four faces excluded the top and bottom faces.

$= 4a^2$



(iii) **Diagonal of cube** = $\sqrt{a^2 + a^2 + a^2} = \sqrt{3a^2}$

$\boxed{\Rightarrow \text{Diagonal} = \sqrt{3}\text{ a units}}$ ✓

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Question

The length of the longest rod that can be placed in a room of dimensions $(10\text{ m} \times 10\text{ m} \times 5\text{m})$ is

15 m

16 m

$10\sqrt{5}$ m

12 m

Question

The length of the longest rod that can be placed in a room of dimensions (10 m × 10 m × 5m) is

A 15 m ✓

B 16 m

C $10\sqrt{5}$ m

D 12 m

Length of longest Rod = diagonal of cuboid

$$= \sqrt{(10)^2 + (10)^2 + (5)^2}$$

$$= \sqrt{100 + 100 + 25} = \sqrt{225}$$

$$= \boxed{15\ m}$$

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Question

If the length of diagonal of a cube is $8\sqrt{3}$ cm then its surface area is

$192\ cm^2$

$384\ cm^2$

$512\ cm^2$

$768\ cm^2$

Question

If the length of diagonal of a cube is $8\sqrt{3}$ cm then its $\boxed{\text{surface area}}$ is

A. $192\ cm^2$

B. $\boxed{384\ cm^2}$ ✓

C. $512\ cm^2$

D. $768\ cm^2$

$\sqrt{a^2+a^2+a^2} = 8\sqrt{3}$

$\sqrt{3a^2} = 8\sqrt{3}$

$a \times \cancel{\sqrt{3}} = 8\cancel{\sqrt{3}}$

$\boxed{a = 8\ cm}$

$TSA = 6a^2$

$= 6 \times (8)^2$

$= 6 \times 64$

$= \boxed{384\ cm^2}$ ✓

$LSA = 4a^2$

$= 4 \times (8)^2$

$= 4 \times 64$

$= \boxed{256\ cm^2}$

Question

The length, breadth and height of a room are 12 cm, 10 cm, and 9 cm respectively. Find the area of four walls of room (in cm^2)?

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Lateral surface Area

$$= 2(b \times h) + 2(h \times l)$$

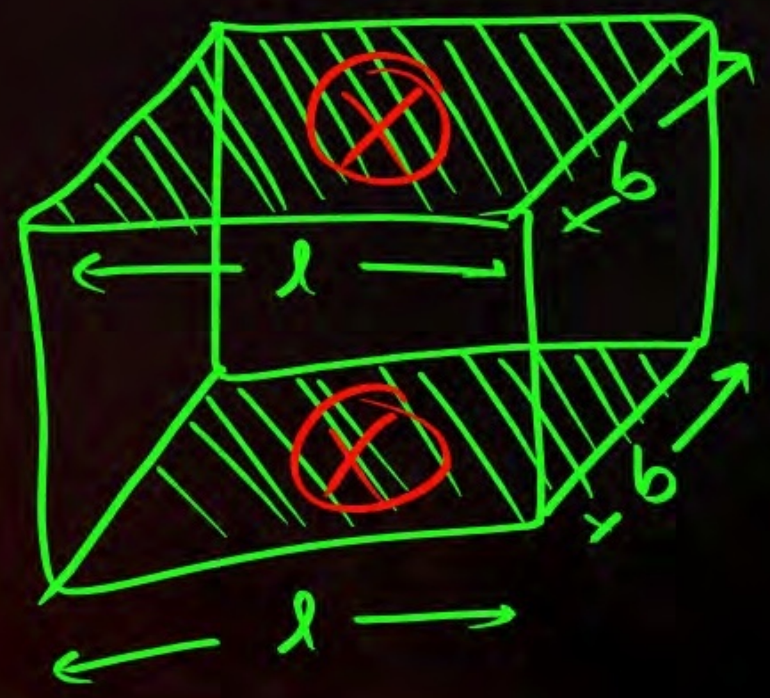
$$= 2(b + l) \times h$$

$$= 2(10 + 12) \times 9$$

$$= (2 \times 22) \times 9$$

$$= 44 \times 9$$

$$= \boxed{396\ cm^2}$$



Question

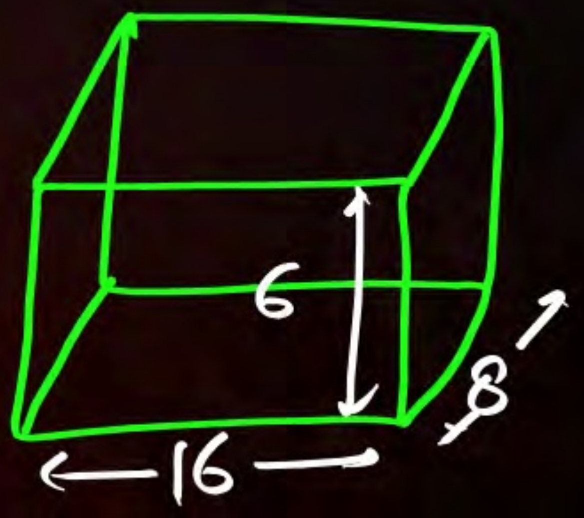
Find the surface area of a chalk box whose length, breadth and height are 16 cm, 8 cm and 6 cm respectively.

Question

Find the surface area of a chalk box whose length, breadth and height are 16 cm, 8 cm and 6 cm respectively.

$$TSA = 2[l \times b + b \times h + h \times l]$$

$$= 2[(16 \times 8) + (8 \times 6) + (6 \times 16)]$$



Question

The dimension of a cuboid are in the ratio of $1 : 2 : 3$ and its total surface area is $88\ m^2$. Find the dimensions.

Question

The dimension of a cuboid are in the ratio of 1 : 2 : 3 and its total surface area is 88 m^2. Find the dimensions.

$l = x$

$b = 2x$

$h = 3x$

A/Q $\quad 2[lb + bh + hl] = 88$

$2[2x^2 + 6x^2 + 3x^2] = 88$

$2[11x^2] = 88$

$22x^2 = 88$

$x^2 = \frac{88}{22}$

$x^2 = 4$

$\boxed{x = 2}$

$\left.\begin{aligned} l &= 2\text{cm} \\ b &= 4\text{ cm} \\ h &= 6\text{ cm.} \end{aligned}\right\}$ Ans.

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Question

$0.65 m$

A plastic box $\boxed{1.5\text{ m}}$ long, $\boxed{1.25\text{ m}}$ wide and $\boxed{65\text{ cm}}$ deep is to be made. It is to be open at the top. Ignoring the thickness of the plastic sheet, determine:

(i) The area of the sheet require for making the box.

(ii) The cost of sheet for it, if a sheet measuring 1 m^2 costs Rs. 20.

Question

A plastic box $\boxed{1.5\text{ m}}$ long, $\boxed{1.25\text{ m}}$ wide and $\boxed{65\text{ cm}}$ deep is to be made. It is to be open at the top. Ignoring the thickness of the plastic sheet, determine:

0.65 m

(i) The area of the sheet require for making the box.

$= TSA - \text{top surface}$ (open box)

$= 2[lb + bh + hl] - lb$

$A = \boxed{2[(1.5 \times 1.25) + (1.25 \times 0.65) + (0.65 \times 1.5)] - (1.5 \times 1.25)}$

(ii) The cost of sheet for it, if a sheet measuring 1 m^2 costs Rs. 20.

$1\text{ m}^2 \longrightarrow ₹20$

Total cost $= ₹20 \times$ (Area calculated)

$= \boxed{₹20 \times A}$

Question

0.3m 0.4m 0.5m

A cuboidal oil tin is 30 cm by 40 cm by 50 cm. Find the cost of the tin required for making 20 such tins if the cost of tin sheet is Rs. 20 per square meter.

Question

$0.3m$ $0.4m$ $0.5m$

A cuboidal oil tin is 30 cm by 40 cm by 50 cm. Find the cost of the tin required for making 20 such tins if the cost of tin sheet is Rs. 20 per square meter.

$$\boxed{\text{Total cost} = 20 \times ₹\,20 \times \text{TSA of one tin (oil) box}} = 20 \times 20 \times 0.94$$

$$= \boxed{₹\,376}$$

Ans

$$TSA = 2[lb + bh + hl]$$

$$= 2[(0.3 \times 0.4) + (0.4 \times 0.5) \times (0.5 \times 0.3)]$$

$$= 2[0.12 + 0.20 + 0.15]$$

$$= 2[0.47] = \boxed{0.94\ m^2}$$

Question

How many square sheets of coloured paper of side 30 cm would be required to cover a wooden box having length, breadth and height as 90 cm, 60 cm and 30 cm respectively?

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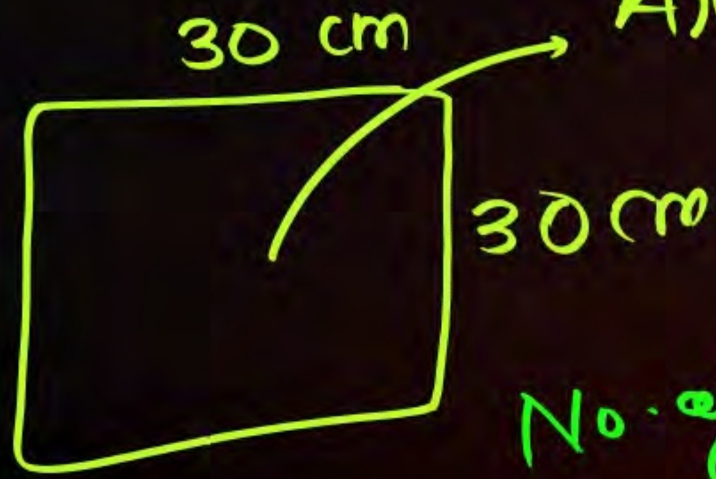


Area of one square sheet = $900\ cm^2$

No. of square sheet Required $= \dfrac{198\cancel{00}}{9\cancel{00}}$

$= 22$ Ans

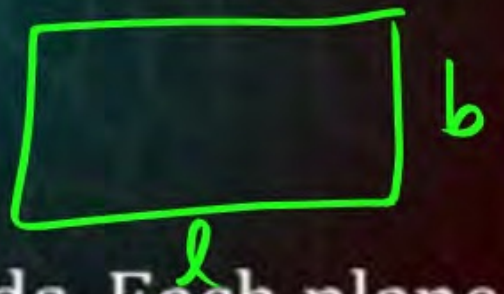
$= 2[5400 + 1800 + 2700]$

$= 2[9900]$

$= 19800\ cm^2$

Right Circular Cylinder

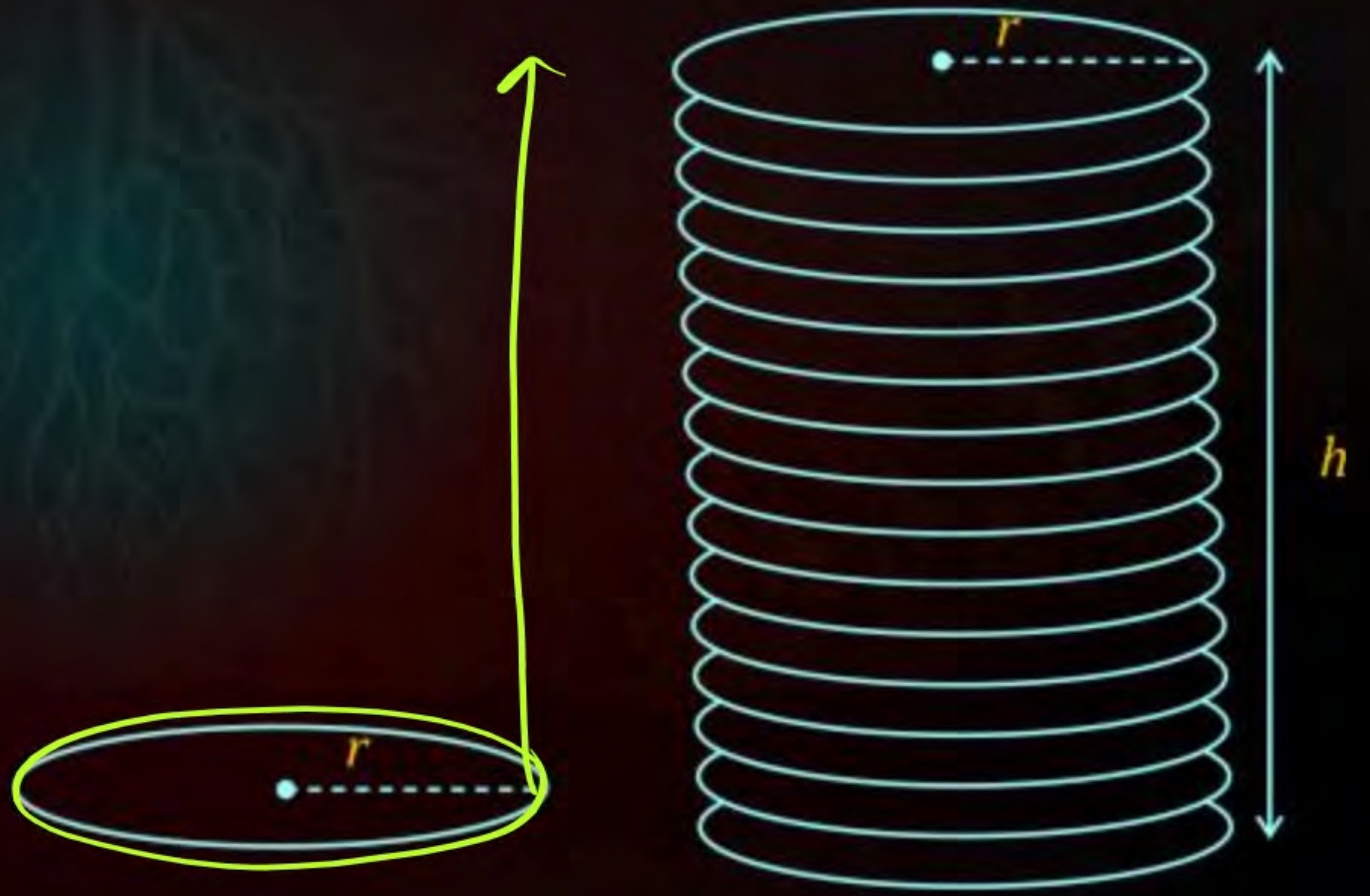
In our day to day life, we come across several solids like measuring jars, circular pillars, circular pipes, a garden roller, gas cylinder etc. These solids have a curved (lateral) surfaces with congruent circular ends. Such solids are right circular cylinders.



A right circular cylinder has two plane ends. Each plane end is circular in shape, and the two plane ends are parallel; that is, they lie in parallel planes. Each of the plane end is called a base of the cylinder.

Important Remark

If we take a number of circular sheets and stake them up vertically as show in we get a right circular cylinder.



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Definitions: Right Circular Cylinder

I. Base: The circular ends of a right circular cylinder on which the cylinder rest is called its base.

II. Axis: The axis of the right circular cylinder is the line segment joining the centers of two circular bases and is perpendicular to the base of the right circular cylinder.

III. Radius(r): The radius of the cylinder is the radius of a base.

Definitions: Right Circular Cylinder

IV. **Height(h):** The length of the axis of the cylinder is called the height of the cylinder. The height of the right circular cylinder is the perpendicular distance between the circular bases. It is the length of the axis of the cylinder.

V. **Lateral Surface:** The curved surface between the two bases of a right circular cylinder that joins the bases is called its lateral surface.

Parts of Right Circular Cylinder

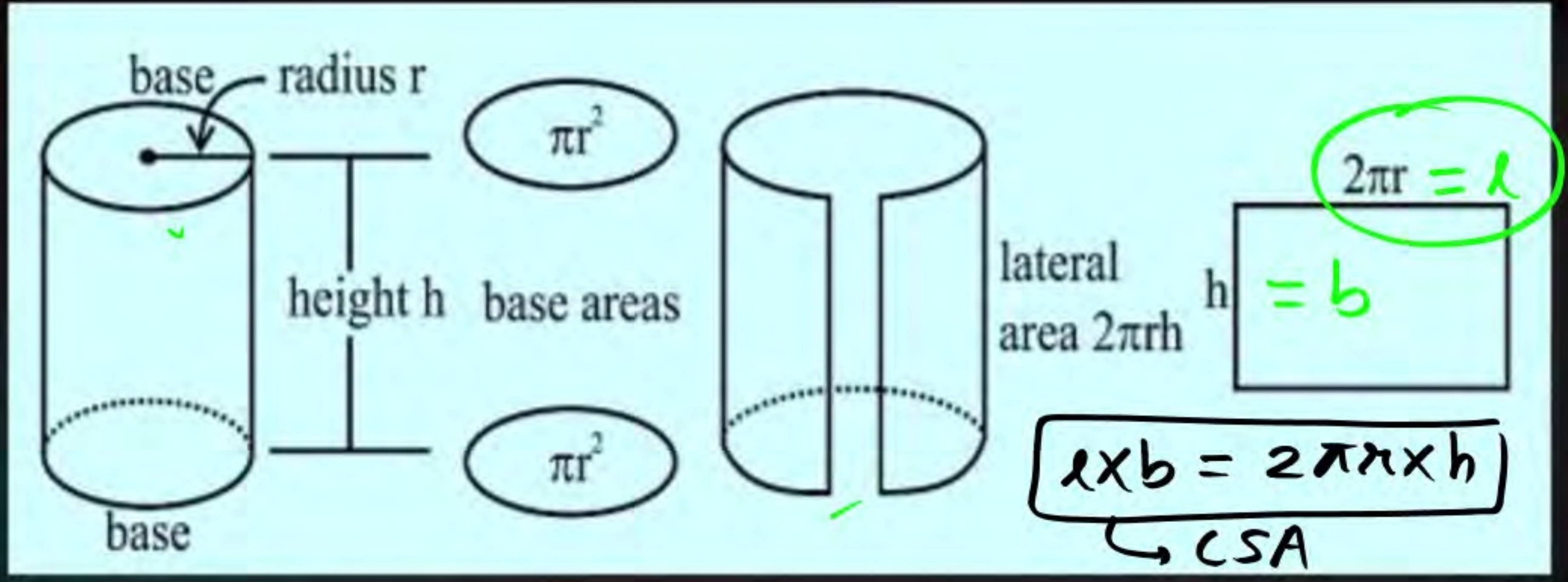
The three parts of the right circular cylinder are:

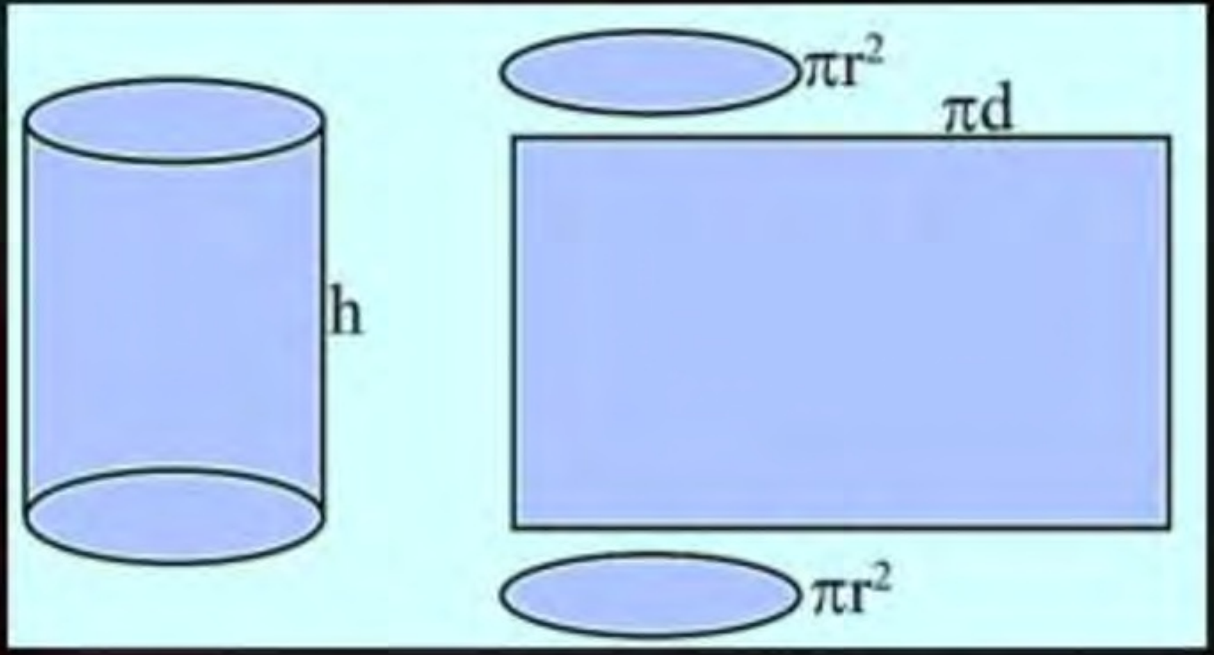
- Top circular base
- Curved lateral face (LSA)
- Bottom circular face

Surface area of a Right Circular Cylinder

$$\boxed{\text{CSA of cylinder} = 2\pi r h}$$

$2\pi r \times h$





$$\begin{aligned} TSA &= CSA + Top + Bottom \\ &= 2\pi rh + \pi r^2 + \pi r^2 = 2\pi rh + 2\pi r^2 \\ &= \boxed{2\pi r(h+r)}^{***} \end{aligned}$$

Question

A rectangular sheet of paper 44 cm × 18 cm is rolled along its length and a cylinder is formed. Find the radius of the cylinder.

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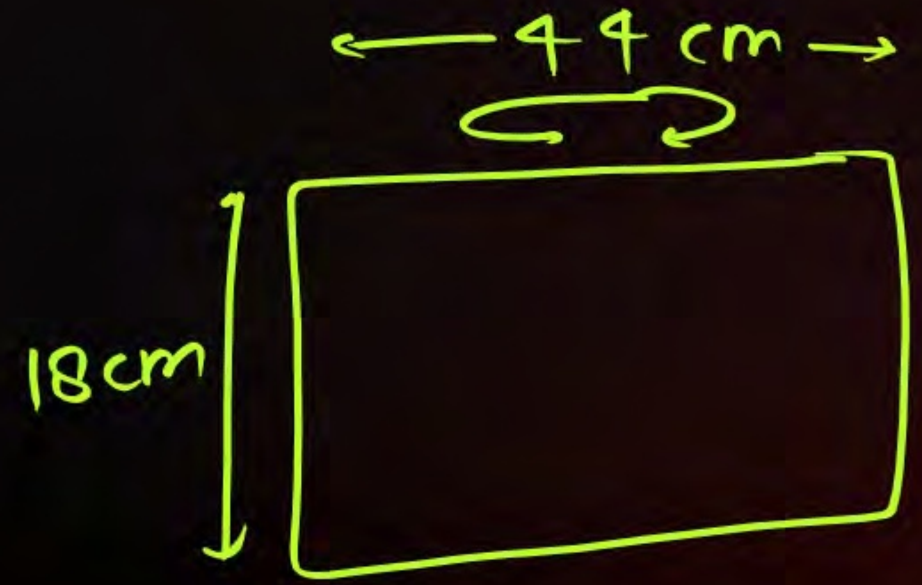
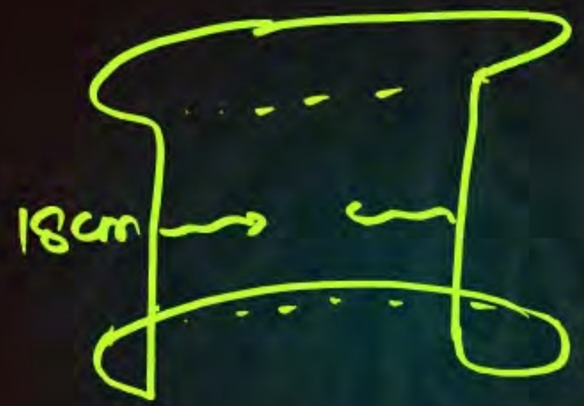
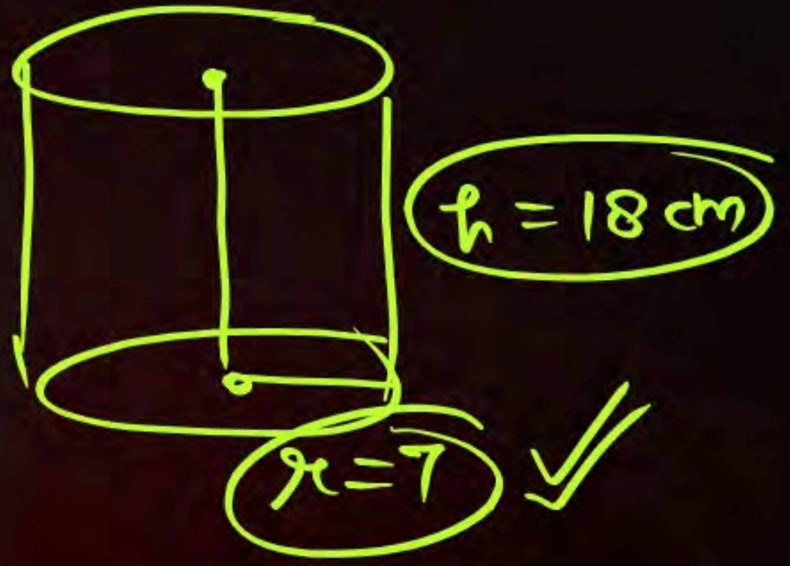






$$l = 2\pi r$$

$$44 = 2 \times \frac{22}{7} \times r$$

$$\frac{44 \times 7}{44} = r \Rightarrow \boxed{r = 7 cm}$$

Question

The diameter of a roller 120 cm long is 84 cm. If it takes 500 complete revolutions to level a playground, determine the cost of levelling it at the rate of 30 paise per square meter.

Question

The diameter of a roller 120 cm long is 84 cm. If it takes 500 complete revolutions to level a playground, determine the cost of levelling it at the rate of 30 paise per square meter.

$d = 2r = 84\,cm$

$\boxed{r = 42\,cm}$

$l = \boxed{h = 120\,cm}$

In 1 rev. it will level area equal to its CSA.

Total leveled Area

$= 500 \times CSA$

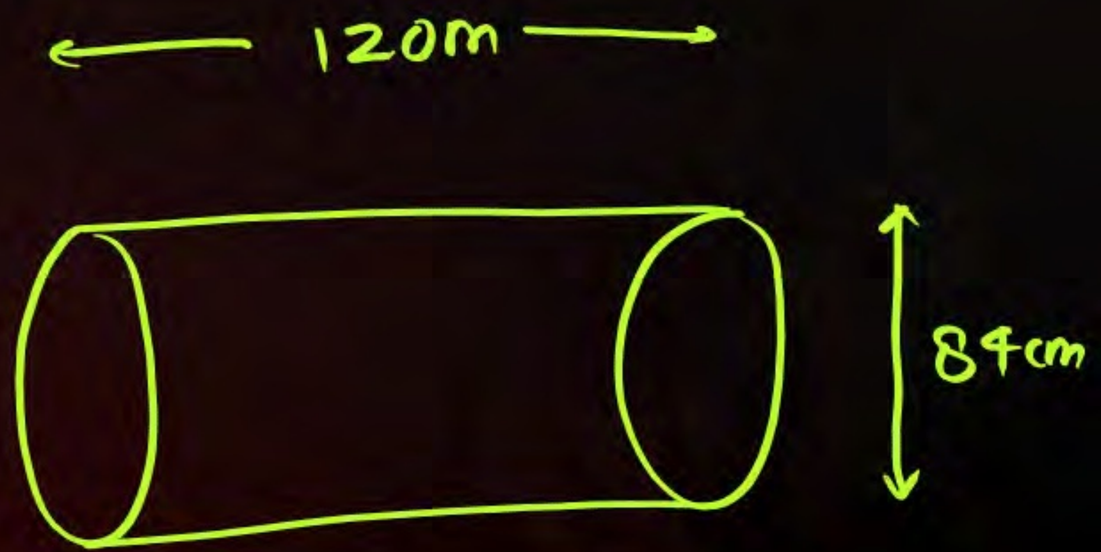
$= 500 \times 2\pi r h$

$= 500 \times 2 \times \frac{22}{\cancel{7}} \times \overset{6}{\cancel{42}} \times 120$

$= 500 \times 2 \times 22 \times 6 \times 120 \; cm^2$

$= \boxed{\frac{500 \times 2 \times 22 \times 6 \times 120}{10000} \; m^2}$

$= 1584\,m^2$



$1\,cm = \frac{1}{100}\,m$

$1\,cm \times 1\,cm = \frac{1}{100}\,m \times \frac{1}{100}\,m$

$\boxed{1\,cm^2 = \frac{1}{10000}\,m^2}$

Total cost :-

30 paise → 0.30 ₹

$1\,m^2 \longrightarrow 0.30$ ₹

$1584\,m^2 = 0.30 \times 1584$

$= \boxed{₹\,475.20}$

Question

A metal pipe is 77 cm long. The inner diameter of a cross section is 4 cm, the outer diameter being 4.4 cm. Find its

(i) Inner curved surface area.

(ii) Outer curved surface area.

(iii) Total surface area.

Question

A cylindrical pillar is 50 cm in diameter and 3.5m in height. Find the cost painting the curved surface of the pillar at the rate of 12.50 per m^2.

Right Circular Cone

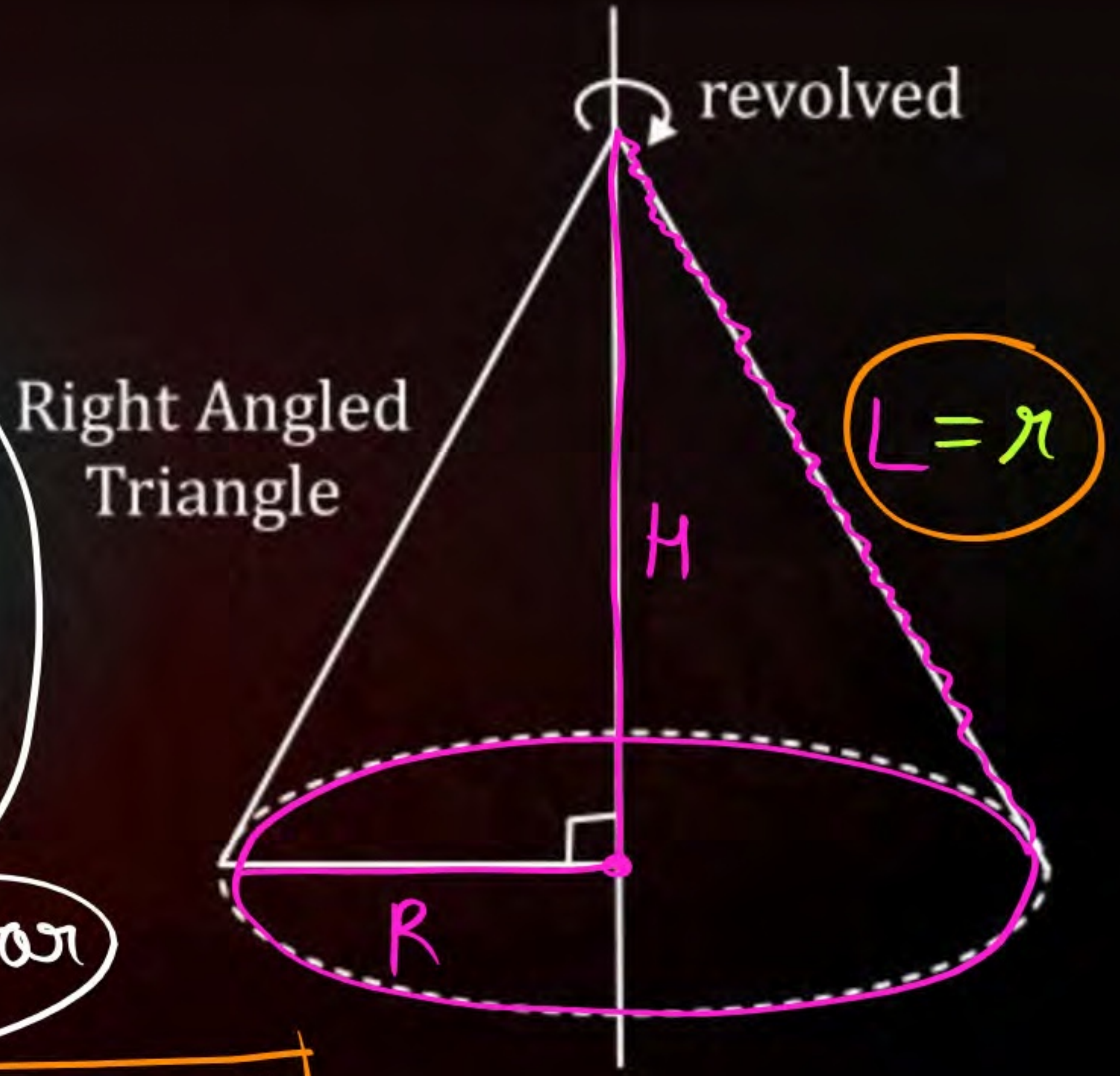
In our every-day life, we come across objects like an ice-cream cone, a conical tent, a conical vessel, a clown's cap, a tapered end of a pencil etc. These objects bring to our mind the concept of a right circular cone, which may be defined as follows:

A right circular cone is a solid generated by revolving a line segment which passes through a fixed point and which makes a constant angle with a fixed line.

r

sector

$$\boxed{\frac{\theta}{360^\circ} \times 2\pi r = 2\pi R}$$

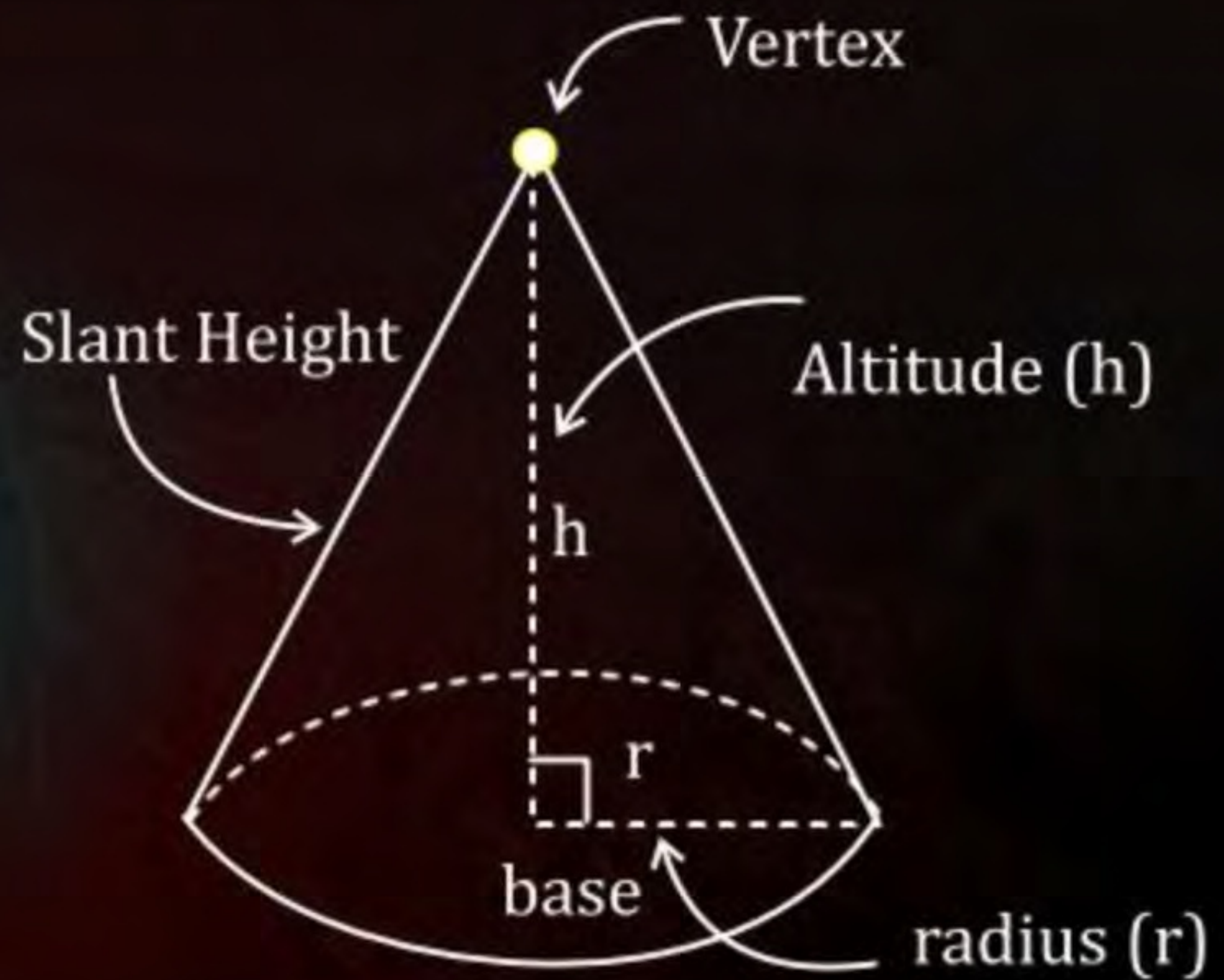


Definitions: Right Circular Cone

Vertex :
The fixed-point V is called the vertex of the cone.

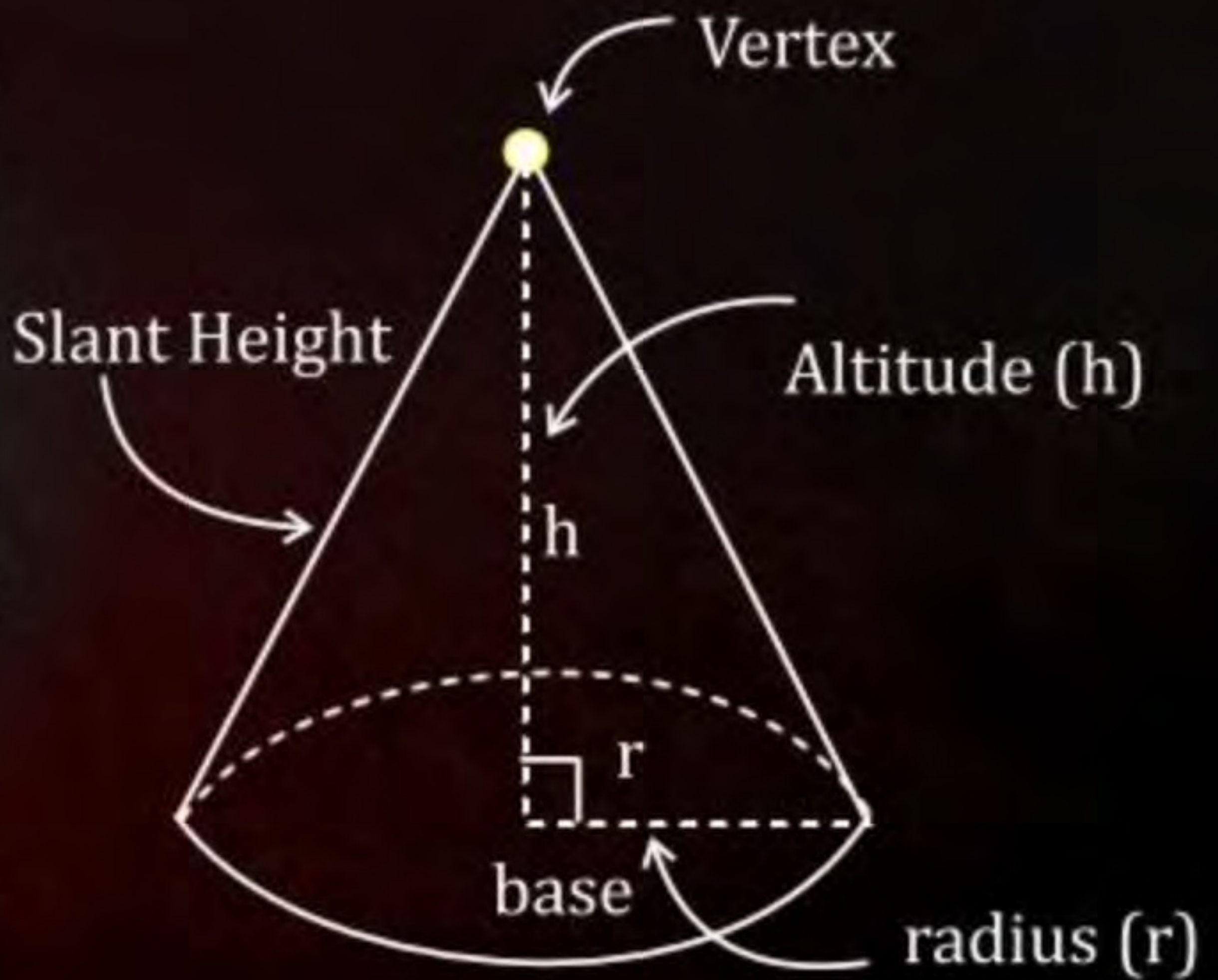
Base :
A right circular cone has a plane end, which is in circular shape. This is called the base of the cone.

Height:
The length of the line segment joining the vertex to the centre of the base is called the height of the cone.



Definitions: Right Circular Cone

Slant Height :
The length of the line segment joining the vertex to any point on the circular edge of the base, is called the slant height of the cone.



Radius :
The radius OA of the base circle is called the radius of the cone.

NOTE: In this chapter, we shall study right circular cones only. Therefore, in what follows, a cone shall mean a right circular cone.

Surface area of a Right Circular Cone

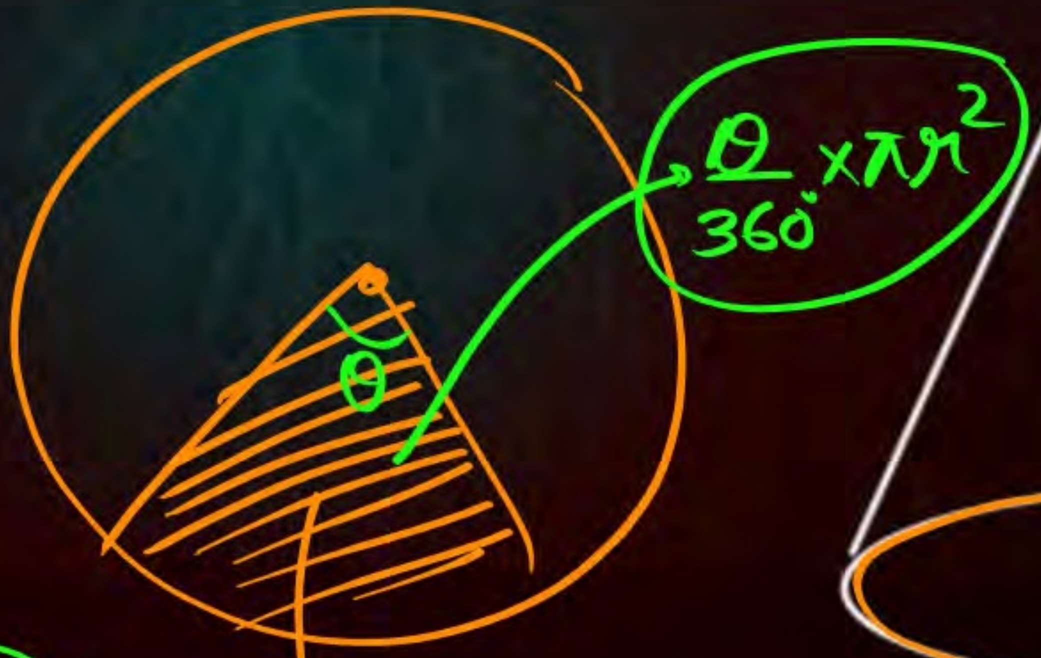
$$\frac{\theta}{360^\circ} \times \cancel{2\pi} r = \cancel{2\pi} R \quad \& \quad L = r$$

$$\boxed{\frac{\theta}{360^\circ} \times r = R}$$

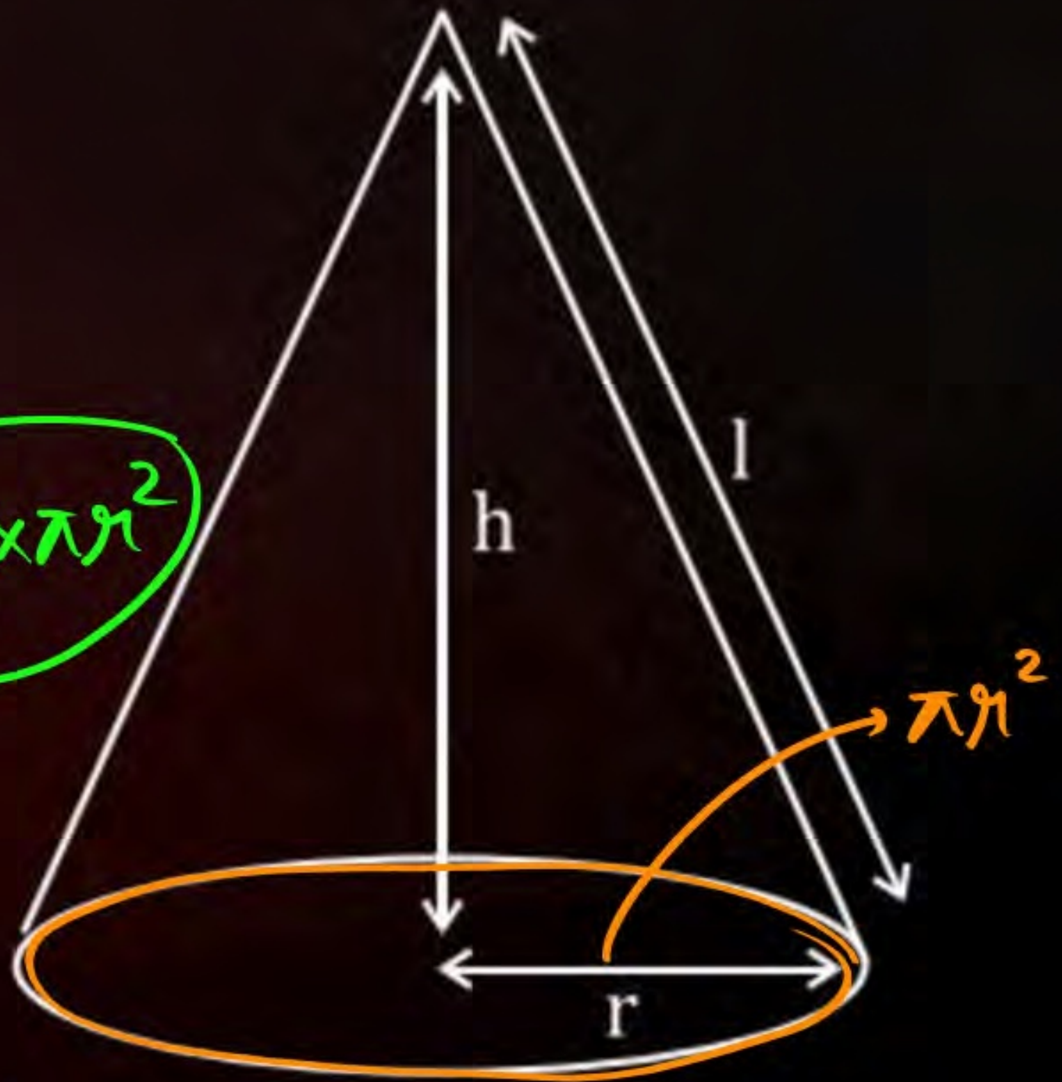
$$CSA_{cone} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$= \left(\frac{\theta}{360^\circ} \times r\right) \times r \times \times \pi$$

$$= R \times L \times \pi = \pi R L$$

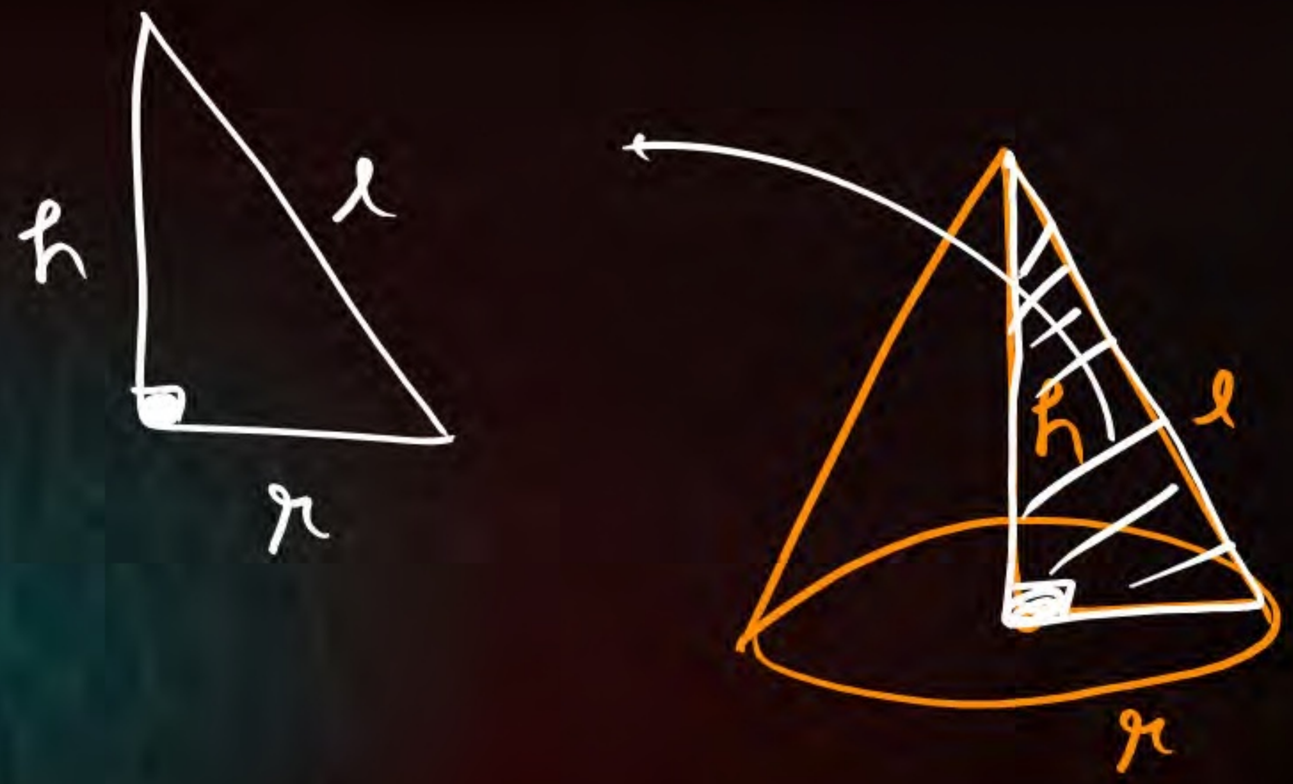


Yahi area
cone ka CSA ban Rha Hai



$$l^2 = h^2 + r^2$$

Slant Height $\Rightarrow \boxed{l = \sqrt{h^2 + r^2}}$



$$CSA = \pi r l$$

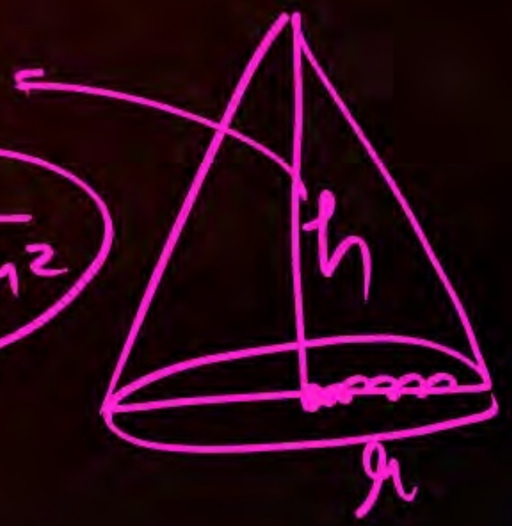
$$TSA = CSA + \text{Bottom area}$$

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

$$= \boxed{\pi r (l + r)} \quad **$$

$$CSA = \pi r l$$

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



Question

The total surface area of a cone whose radius is $r/2$ and slant height $2l$ is

$2\pi r(l + r)$

$\pi r(l + r/4)$

$3\pi r(l + r)$

πrl

Question

The total surface area of a cone whose radius is $r/2$ and slant height $2l$ is

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

B $\boxed{\pi r(l + r/4)}$ ✓

C $3\pi r(l + r)$

D $\pi r l$

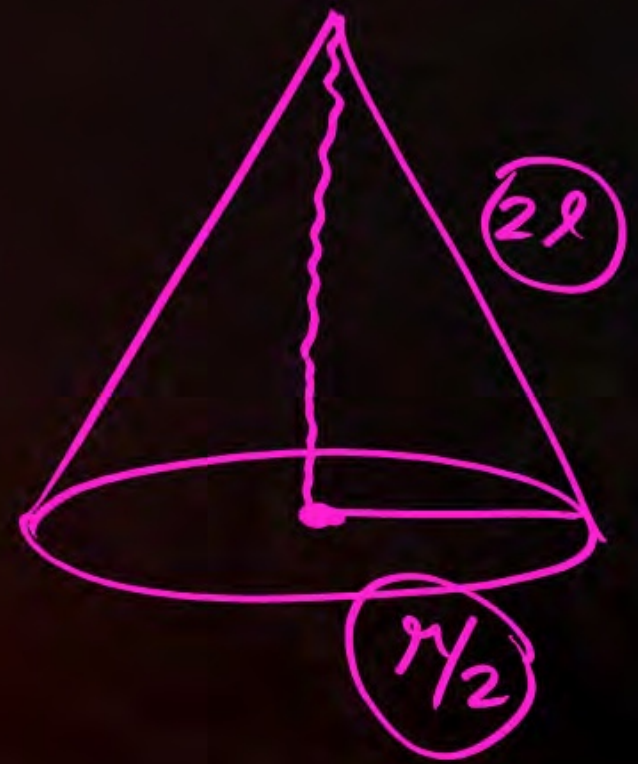
TSA = CSA + Bottom area

= $\pi \times$ radius $\times$ Slant Height + $\pi \times (\text{radius})^2$

$$= \pi\left(\frac{r}{\cancel{2}}\right)\times(\cancel{2}l) + \pi\left(\frac{r}{2}\right)^2$$

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

$$= \boxed{\pi r\left(l + \frac{r}{4}\right)}$$



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Question

The diameter of a cone is 14 cm and its slant height is 9 cm. Find the area of its curved surface.

Question

The radius and slant height of a cone are in the ratio of 4 : 7. If its curved surface area is 792 cm^2, find its radius (Use $\pi = 22/7$).

Question

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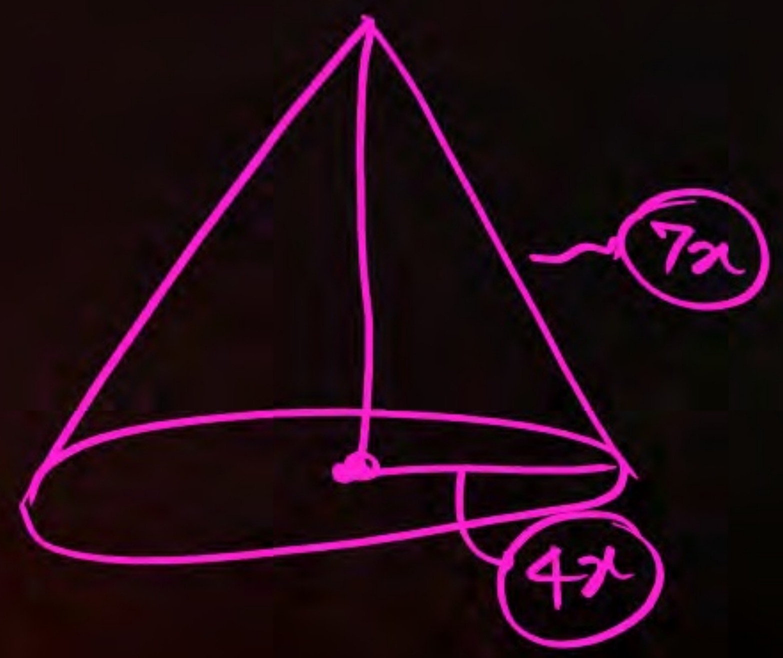

$CSA = \pi r l$

$792 = \frac{22}{\cancel{7}} \times 4x \times \cancel{7}x$

$792 = 88x^2$

$x^2 = \frac{\cancel{792}}{\cancel{88}} = 9$

$x^2 = 9$

$x = 3$ → $\boxed{r = 4 \times 3 = 12 \text{ cm}}$

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Question

A Joker's cap is in the form of a right circular cone of base radius 7 cm and height 24 cm. Find the area of the sheet required to make 10 such caps.

Question

A Joker's cap is in the form of a right circular cone of base radius 7 cm and height 24 cm. Find the area of the sheet required to make 10 such caps.

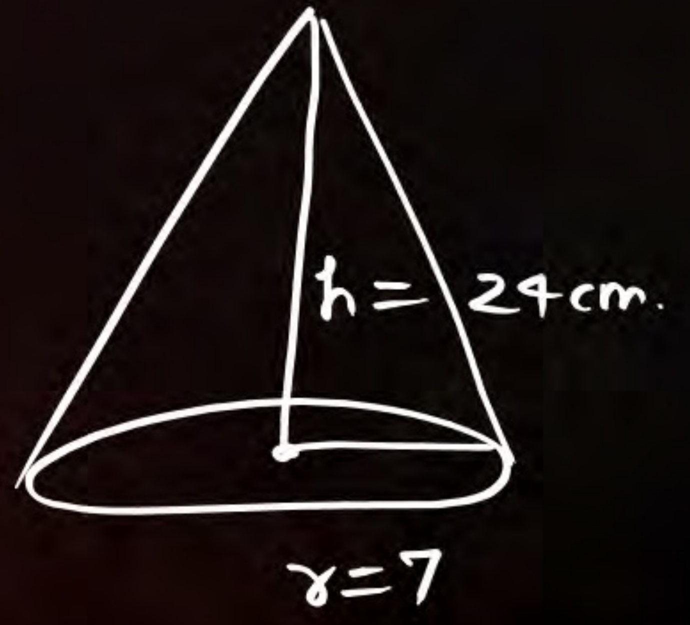
Total Area Required = 10 × Area required for 1 cap

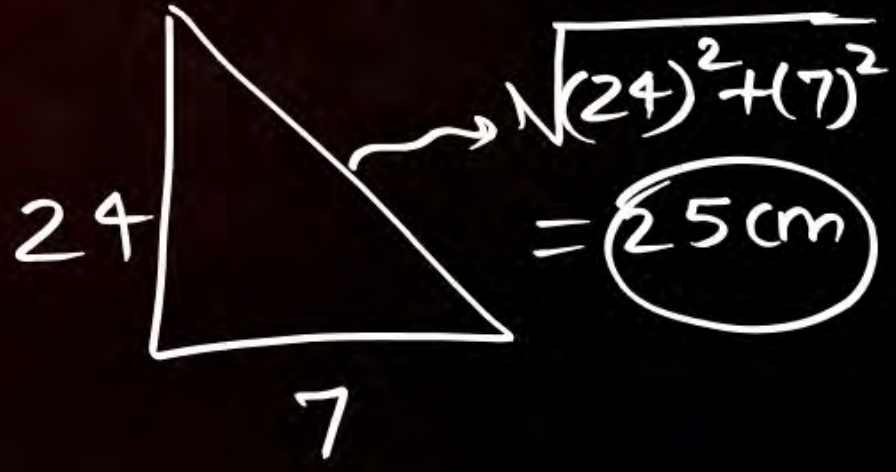
$$= 10 \times CSA$$

$$= 10 \times \pi r l$$

$$= 10 \times \frac{22}{\cancel{7}} \times \cancel{7} \times 25$$

$$= (250 \times 22)\ cm^2$$





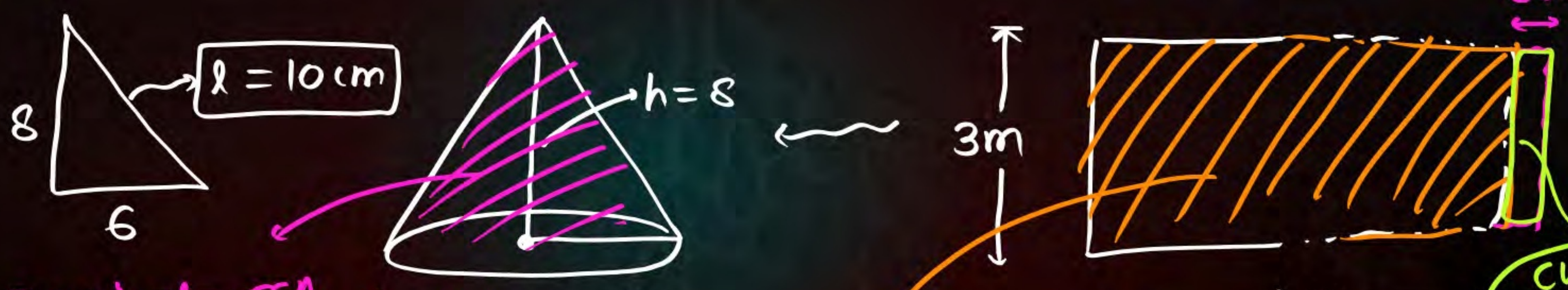
Question

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

Question

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

$= 0.2\,m$



material Required $= CSA_{\text{conical tent}}$ $\quad r = 6\,m$

l (m) → cutting & wastage

$= \pi r l$

$= \left(\frac{22}{7} \times 6 \times 10\right) m^2 = 3 \times l$

$\Rightarrow l = \frac{22 \times 6 \times 10}{7 \times 3}$

$\Rightarrow l = 62.85\,m$

Total length $= 62.85 + 0.20 = 63.05\,m \approx 63\,m$

Sphere

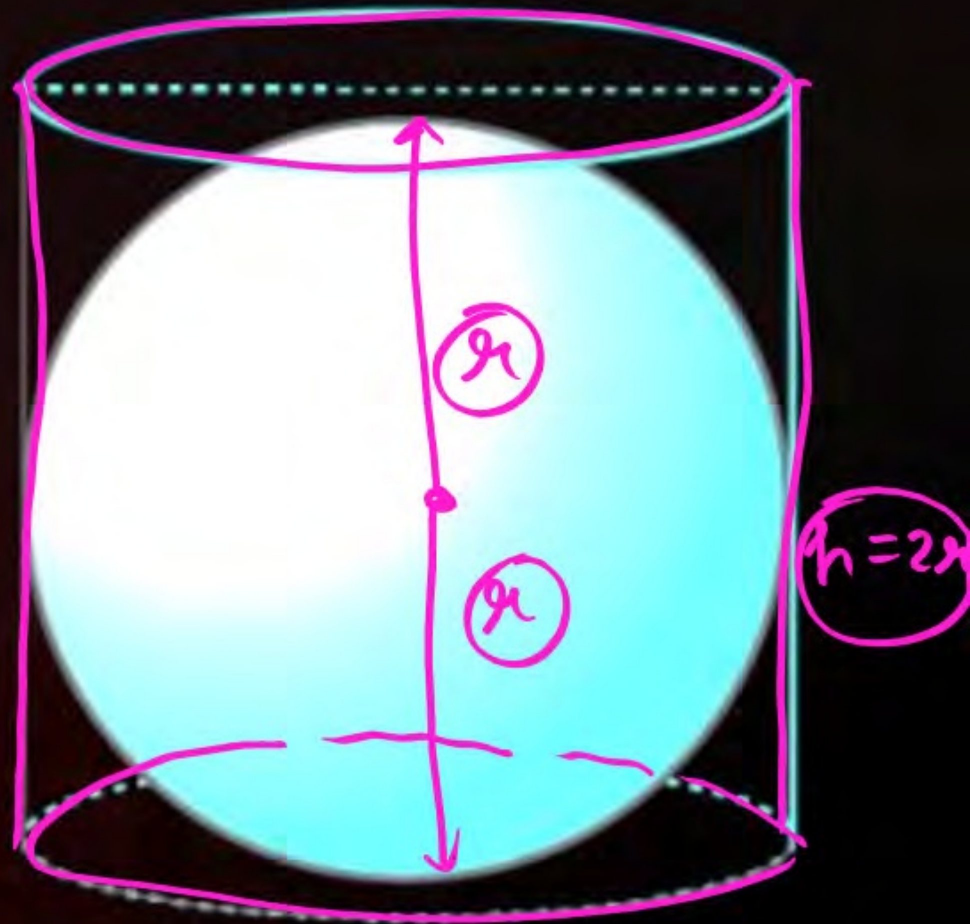
A sphere is a three-dimensional round-shaped object. Unlike other three-dimensional shapes, a sphere does not have any vertices or edges. All the points on its surface are equidistant from its center. In other words, the distance from the center of the sphere to any point on the surface is equal.

A sphere is a three-dimensional figure (solid figure), which is made up of all points in the space, which lie at a constant distance called the radius, from a fixed point called the centre of the sphere.

A tennis ball and a fully blown football are some familiar objects which bring to our mind the concept of a sphere.

Story Time

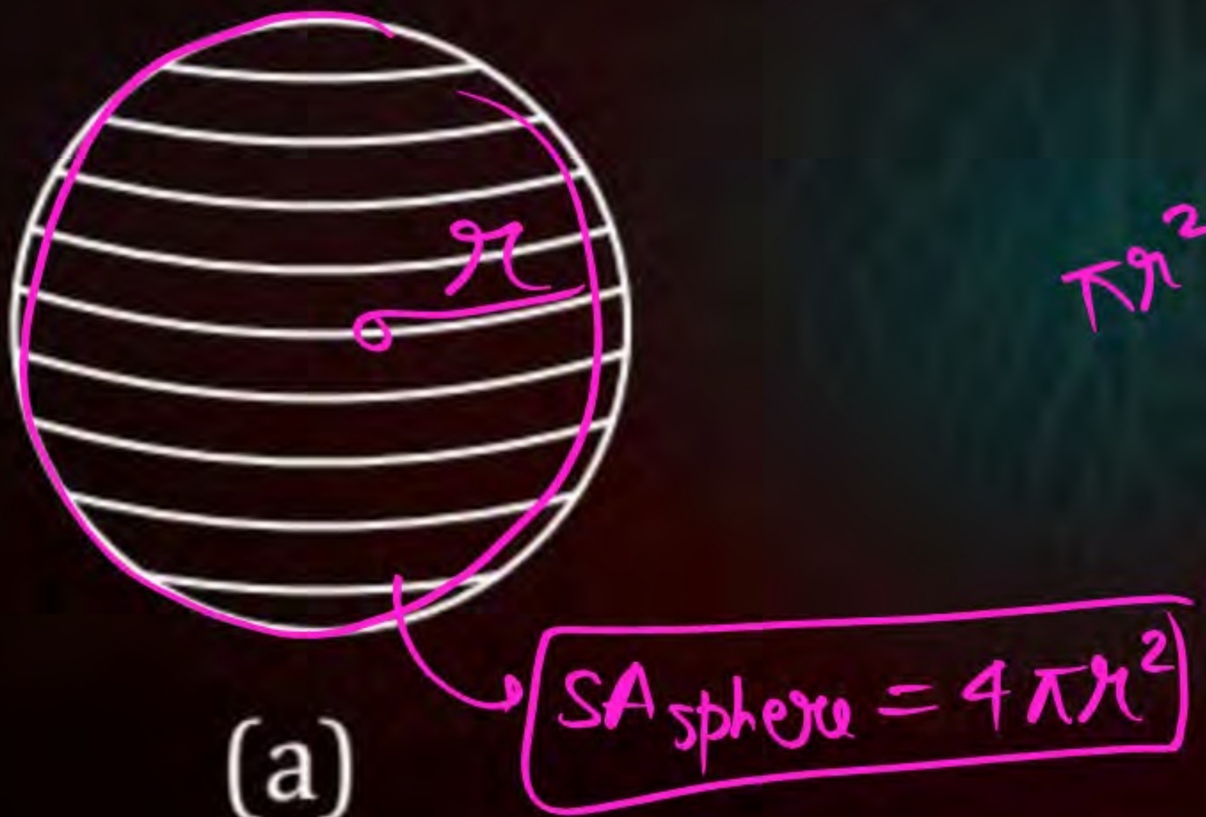
If the radius of a cylinder is the same as the radius of a sphere, it means that the sphere can fit into the cylinder perfectly. This means that the height of the cylinder is equal to the height of the sphere. So, this height can also be called as the diameter of the sphere. Therefore, this fact was proved by a great mathematician, Archimedes, that if the radius of a cylinder and sphere is 'r', the surface area of a sphere is equal to the lateral surface area of the cylinder. Hence, the relation between the surface area of a sphere and lateral surface area of a cylinder is given as:



$\boxed{\text{Surface Area of Sphere = Lateral Surface Area of Cylinder}}$ $= 2\pi rh$

$= 2\pi r \times (2r) = 4\pi r^2$

Let's do some Activity



(a)

(b)

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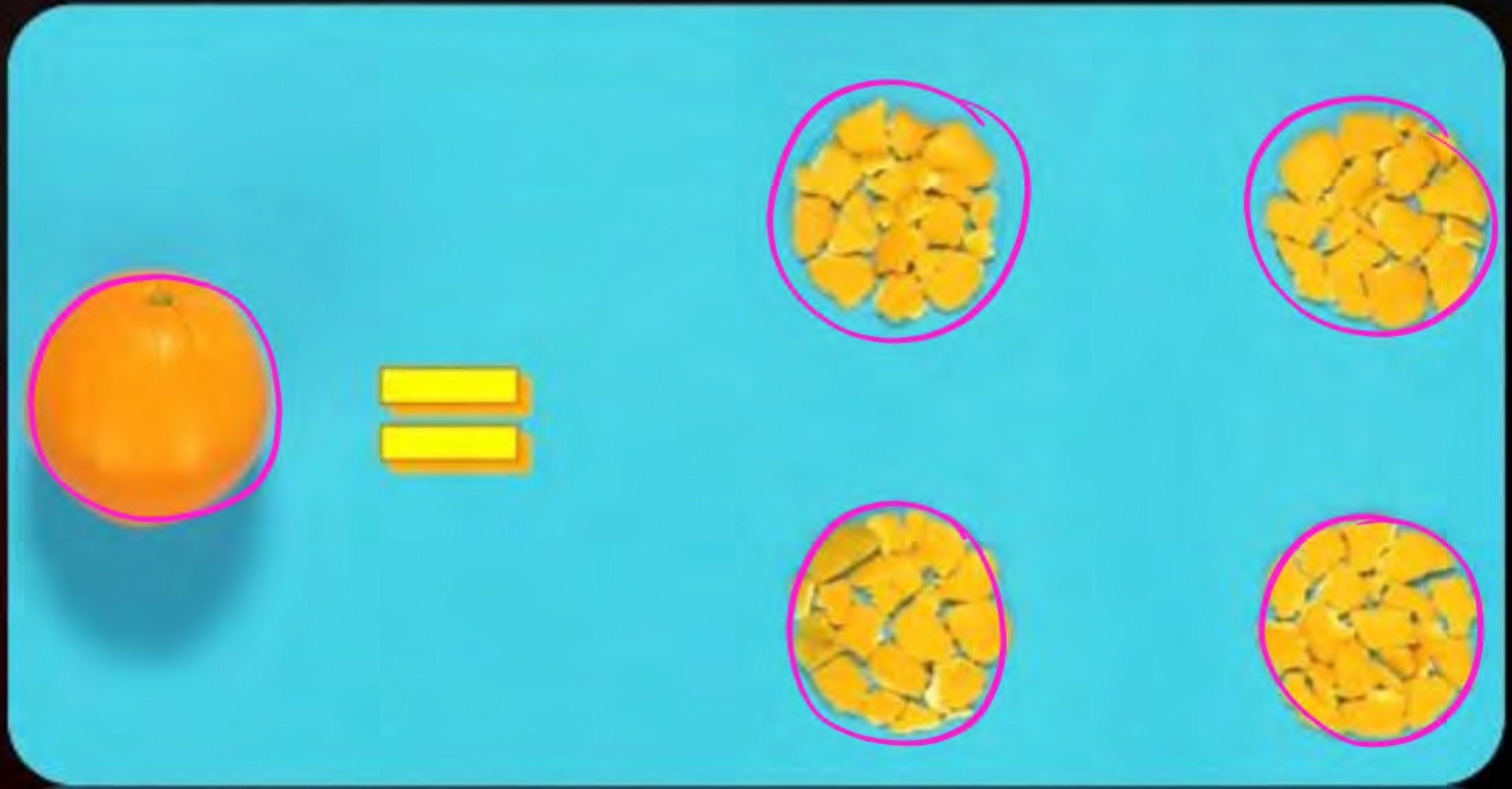
Fun Activity Time

Draw a circle around the orange. The circle should have the same radius as the orange.

$$\boxed{(SA)_{sphere} = 4\pi r^2}$$



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Surface Area (Total Surface Area) of a Sphere

Curved/ Total Surface Area:-

$$\boxed{SA_{sphere} = 4\pi r^2}$$

Hemisphere

The word 'Hemi' means half by which we can say that a hemisphere is exactly half of a sphere. The distance from the centre to the surface is known as the radius. A hemisphere is formed when a plane cuts the sphere at the centre in two equal parts.

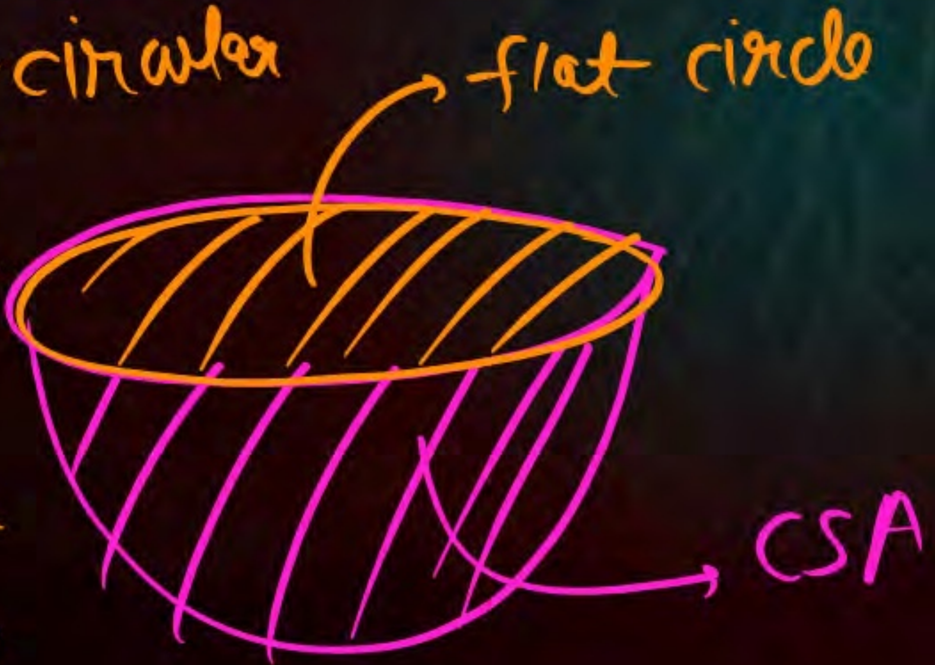
$$CSA = \frac{4\pi r^2}{2} = 2\pi r^2 \checkmark$$

TSA = CSA + flat circular area

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

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

$$= \boxed{3\pi r^2} \checkmark$$



Surface Area of Hemisphere

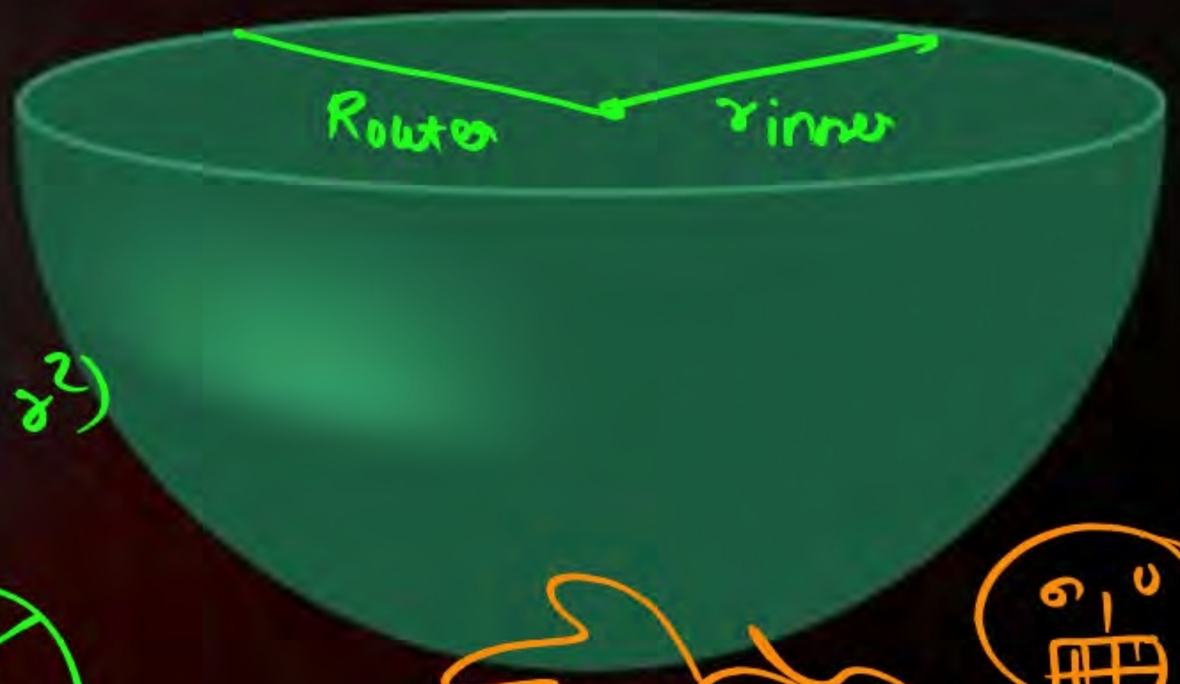
Curved Surface Area : $= 2\pi r^2$

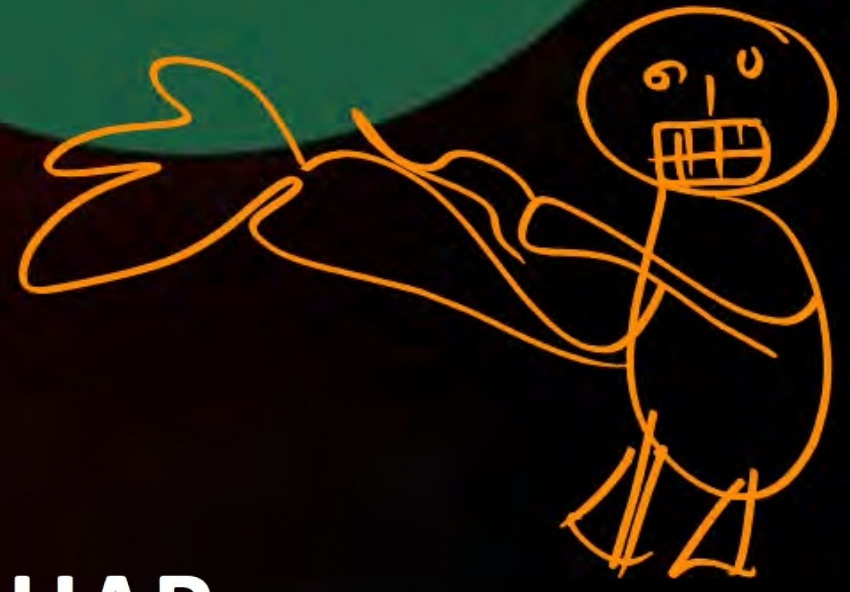
Hollow Hemi-sphere $= 2\pi(R^2 - r^2)$

Total Surface Area : $= 3\pi r^2$

$= \boxed{2\pi R^2 + \pi(R^2 - r^2)}$ *

$\pi(R^2 - r^2)$





Question

Find the surface area of a sphere of radius 7 cm.

Question

Find the surface area of a sphere of radius 7 cm.

$$(SA)_{sphere} = 4\pi r^2$$

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

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

$$= 88 \times 7$$

$$= \boxed{616\ cm^2}$$

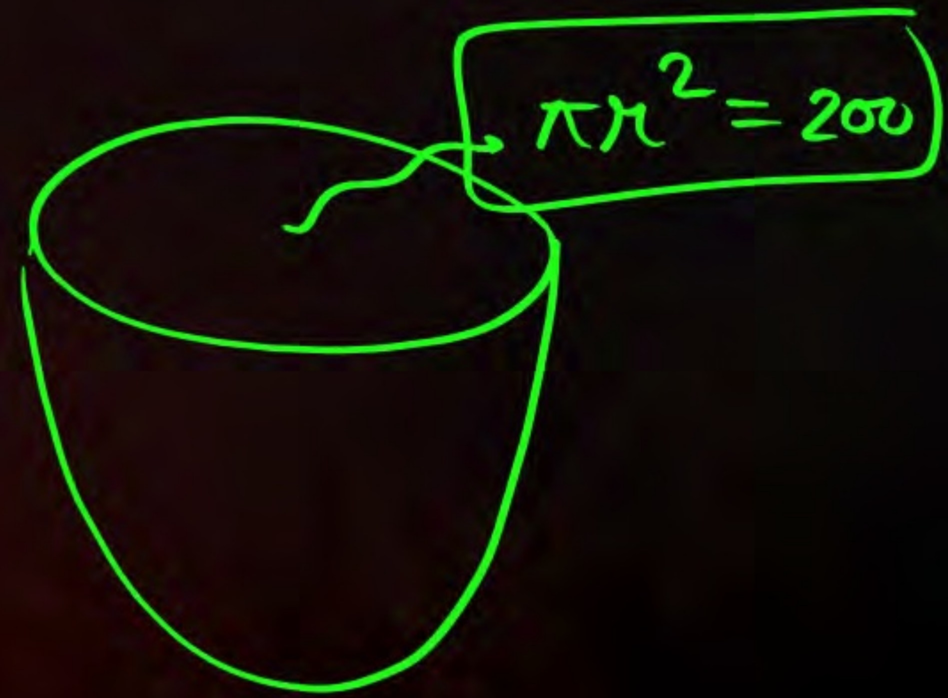
Question

The area of the flat surface of a hemisphere is 200 cm^2. Find its total surface area.

Question

The area of the flat surface of a hemisphere is 200 cm^2. Find its total surface area.

$$\begin{aligned} TSA &= CSA + \text{flat} \\ &= 2\pi r^2 + \pi r^2 \\ &= 3\pi r^2 \\ &= 3 \times 200 \\ &= \boxed{600\ cm^2} \end{aligned}$$



Question

A hemispherical bowl is made of steel, 0.25 cm thick. The inner radius of the bowl is 5 cm. Find the outer curved surface area of the bowl.

Question

A hemispherical bowl is made of steel, 0.25 cm thick. The inner radius of the bowl is 5 cm. Find the outer curved surface area of the bowl.

$R - r = 0.25m$

$\boxed{r = 5cm.}$

$R - r = 0.25$

$R = r + 0.25$

$R = 5 + 0.25$

$\boxed{R = 5.25\ cm}$

$(CSA)_{outer} = 2\pi(R)^2$

$= \boxed{2 \times \frac{22}{7} \times (5.25)^2}$

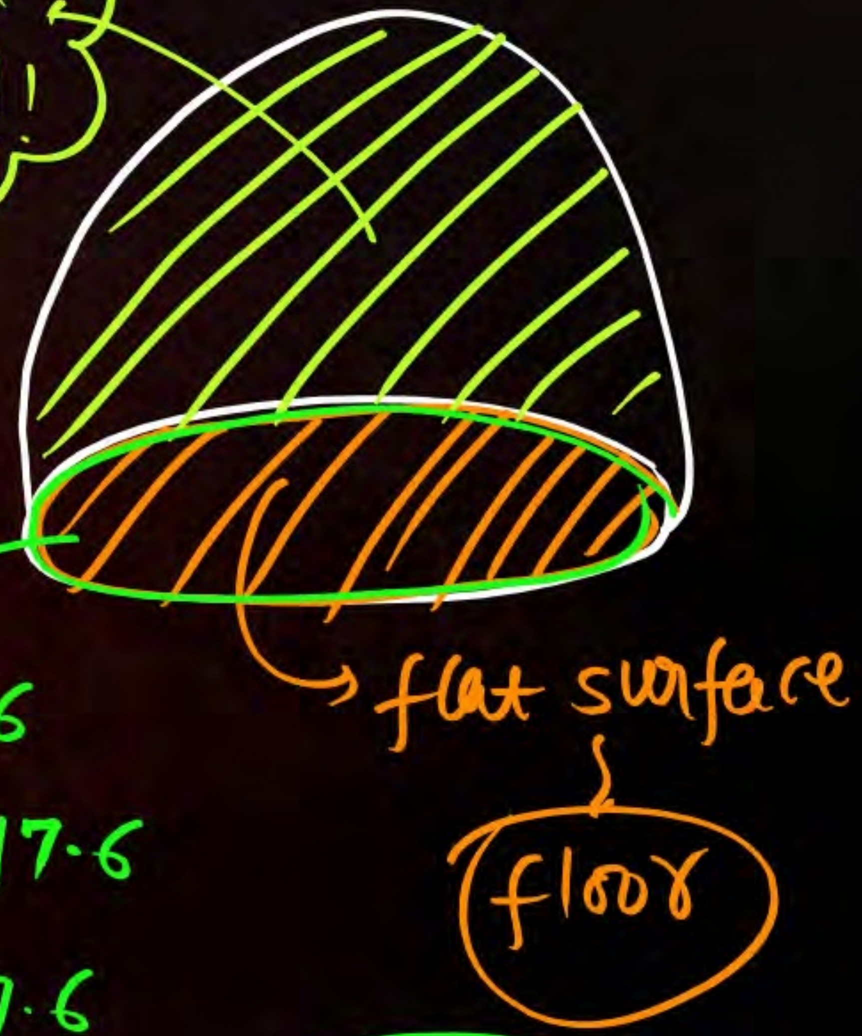
Question

A hemi-sphere dome of a building needs to be painted. If the circumference of the base of the dome is 17.6 cm, find the cost of painting it, given the cost of pointing is Rs. 5 per 100 cm^2.

Question

A hemi-sphere dome of a building needs to be painted. If the circumference of the base of the dome is 17.6 cm, find the cost of painting it, given the cost of pointing is $\boxed{\text{Rs. } 5 \text{ per } 100 \text{ cm}^2}$.

CSA hi paint Hua Hoga!!



Area to be painted $= 2\pi r^2$

$= 2 \times \frac{22}{7} \times (2.8)^2$

$= 49.28 \text{ cm}^2$

$2\pi r = 17.6$

$2 \times 3.14 \times r = 17.6$

$6.28 \times r = 17.6$

$r = \frac{17.6}{6.28} = 2.8 \text{ cm}$

$100 \text{ cm}^2 \longrightarrow ₹5$

$1 \text{ cm}^2 \longrightarrow \frac{₹5}{100}$

$49.28 \text{ cm}^2 \longrightarrow \frac{49.28 \times 5}{100} = \boxed{2.464}$ ₹

Question

The radius of spherical balloon increase from 7 cm to 14 cm as air is being pumped into it. Find the ratios of the surface areas of the balloon in the two cases.

Question

The surface area of a sphere of radius 5 cm is five times the curved surface area of a cone of radius 4 cm. Find the height of the cone.

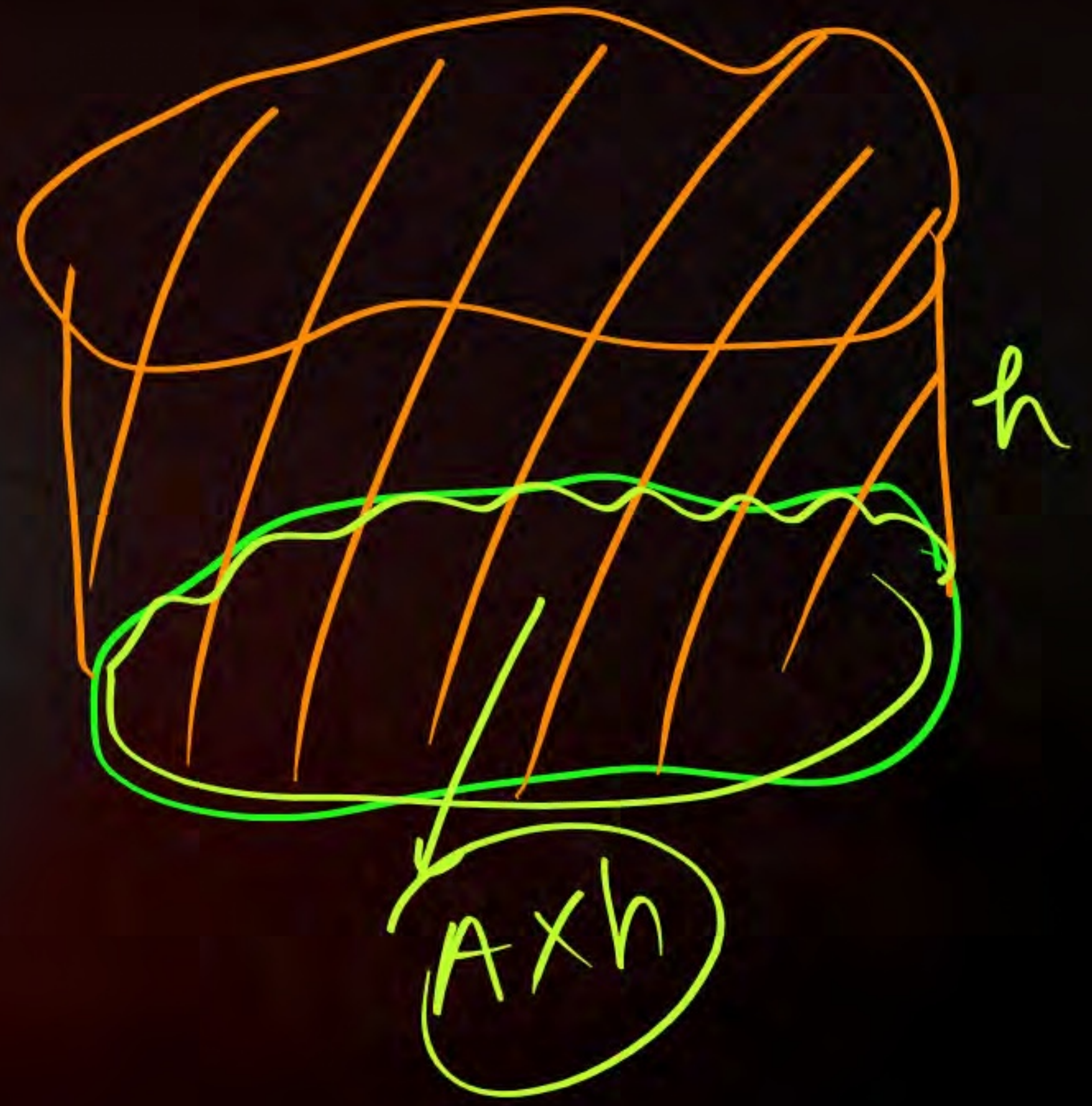
Volume and Capacity

If an object is solid, then the space occupied by such an object is measured, and is termed the Volume of the object.

On the other hand, if the object is hollow, then interior is empty, and can be filled with air, or some liquid that will take the shape of its container. In this case, the volume of the substance that can fill the interior is called the capacity of the container.

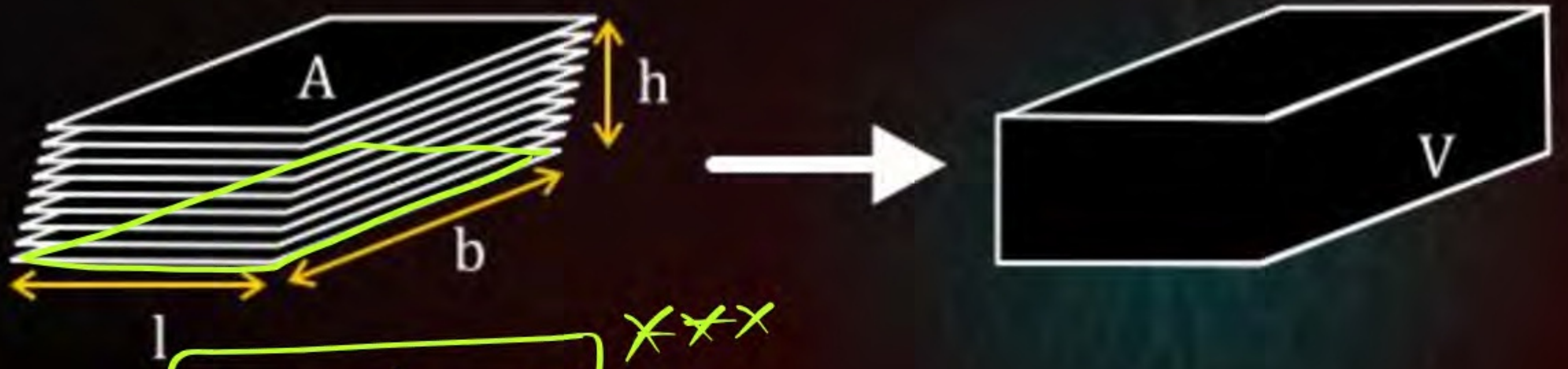
In short, the volume of an object is the measure of the space it occupies, and the capacity of an object is the volume of substance its interior can accommodate. Hence, the unit of measurement of either of the two is cubic unit.

$\boxed{\text{Volume} = \text{Base Area} \times \text{Height}}$

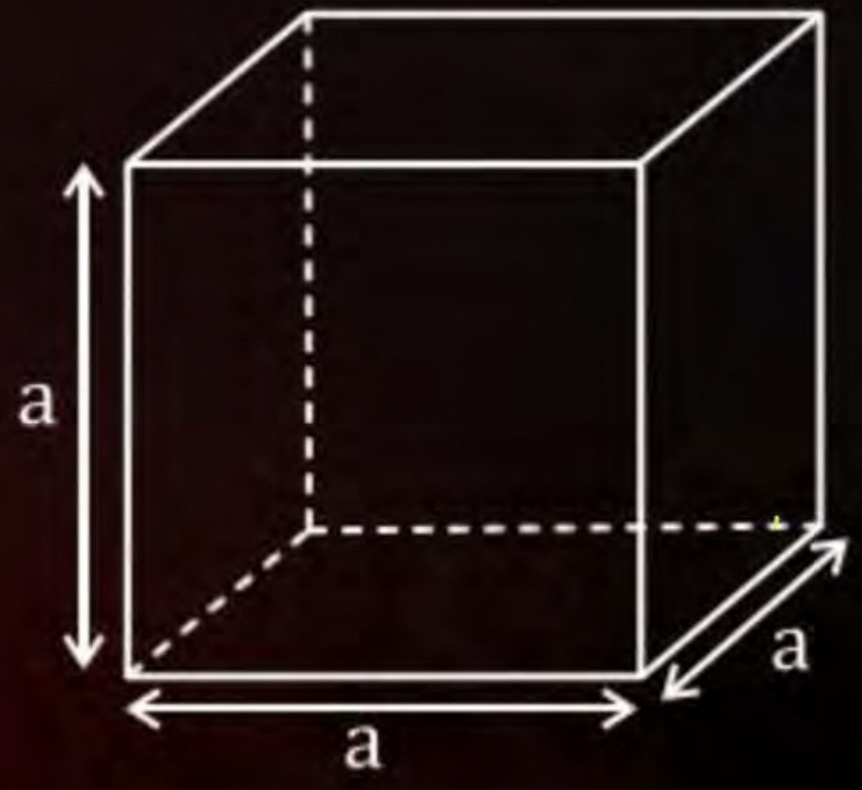


Volume of Cuboid and Cube

$$\boxed{\text{Volume} = \text{Base Area} \times \text{Height}}$$



$$\boxed{l \times b \times h = V}^{***}$$



$$V = a \times a \times a$$

$$\boxed{V = a^3}^{**}$$

Question

A match box measured 4 cm × 2.5 cm × 1.5 cm. What will be the volume of a packet containing 12 such boxes?

Question

A match box measured 4 cm × 2.5 cm × 1.5 cm. What will be the volume of a packet containing 12 such boxes?

cm^2 — surface Area

Total volume = 12 × volume of one match box

$= 12 \times [l \times b \times h]$

$= 12 \times (4 \times 2.5 \times 1.5)$

cm^3 → volume

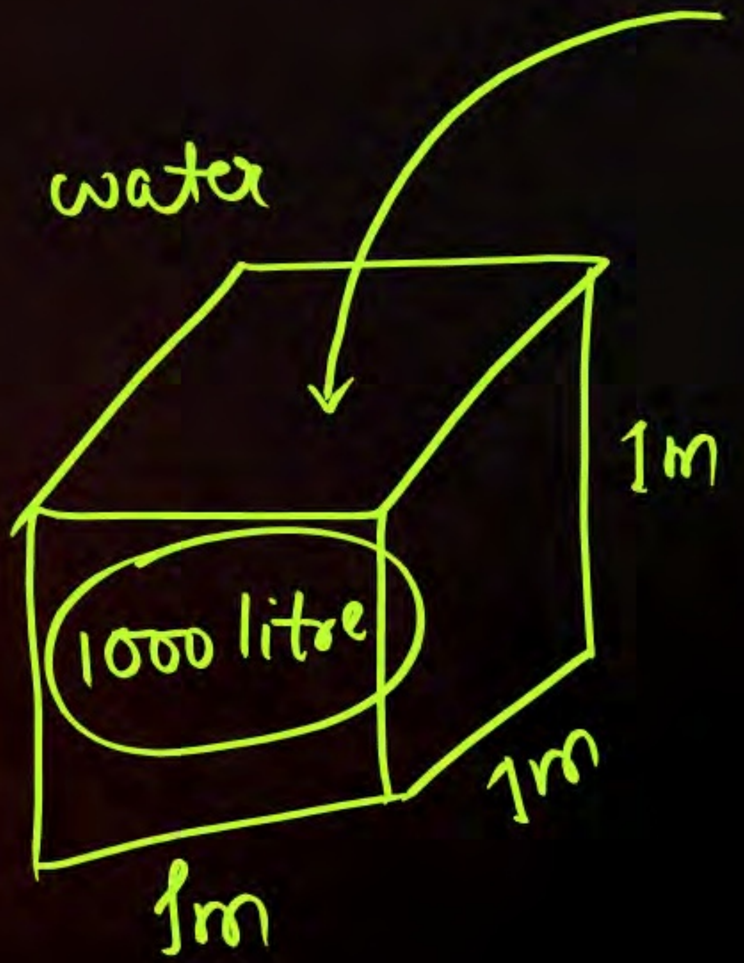
Question

The capacity of a cuboidal tank is 50, 000 liters. Find the breadth of the tank if its length and depth are respectively 2.5 m and 10 m.

Question

The capacity of a cuboidal tank is 50, 000 liters. Find the breadth of the tank if its length and depth are respectively 2.5 m and 10 m.

$$\boxed{1\,m^3 \longrightarrow 1000 \text{ litre}}$$



$$\text{capacity} = 50{,}000 \text{ litre}$$
$$= 50 \times 1000 \text{ litre}$$
$$= 50 \times 1\,m^3$$
$$= 50\,m^3$$

$$\text{capacity} = l \times b \times h \Rightarrow 50 = 2.5 \times b \times 10$$
$$b = \frac{50}{2.5 \times 10} = \frac{50}{25} = 2m$$

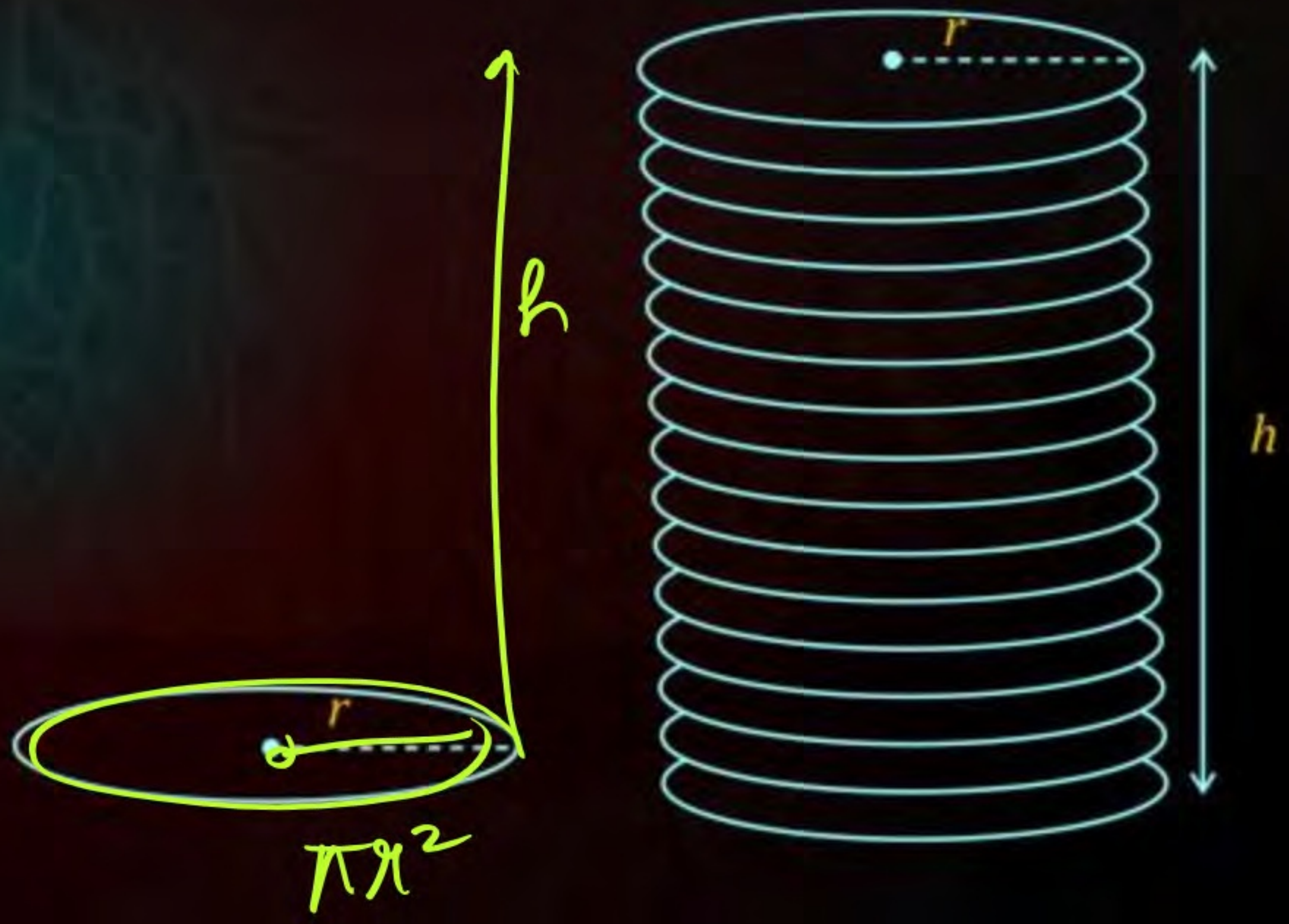
Question

A river 3 m deep and 40 m wide is flowing at the rate of 2 km per hour. How much water will fall into the sea in a minute.

Volume of a Cylinder

Volume of the cylinder = Measure of the space occupied by the cylinder.

$$\boxed{V = \pi r^2 h} \quad ***$$



Question

Find the volume of a right circular cylinder, if the radius (r) of its base and height (h) are 7 cm and 15 cm respectively.

Question

Find the volume of a right circular cylinder, if the radius (r) of its base and height (h) are 7 cm and 15 cm respectively.

$$V_{cylinder} = \pi r^2 h$$

$$= \frac{22}{7} \times (7)^2 \times 15$$

$$= \frac{22}{\cancel{7}} \times \cancel{7} \times 7 \times 15$$

$$= (22 \times 7 \times 15)\ cm^3$$

Question

At a Ramzan Mela, a stall keeper in one of the food stalls has a large cylindrical vessel of bas radius 15 cm filled up to a height of 32 cm with orange juice. The juice is filled in small cylinder glasses (see fig.) of radius 3 cm up to a height of 8 cm, and sold for Rs. 15 each. How much money does the stall keeper receive by selling the juice completely.

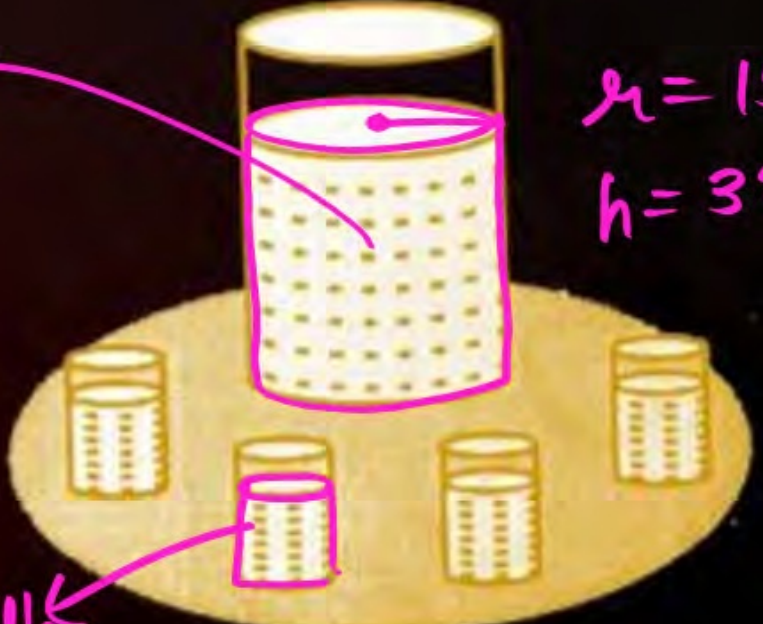
Question

At a Ramzan Mela, a stall keeper in one of the food stalls has a large cylindrical vessel of bas radius 15 cm filled up to a height of 32 cm with orange juice. The juice is filled in small cylinder glasses (see fig.) of radius 3 cm up to a height of 8 cm, and sold for Rs. 15 each. How much money does the stall keeper receive by selling the juice completely.

Amount of juice = capacity

$= \pi r^2 h$

$= \frac{22}{7} \times (15)^2 \times 32$



$r = 15$ cm.

$h = 32$ cm

No. of glass filled with orange juice $= \dfrac{\cancel{\frac{22}{7}} \times (15)^2 \times 32}{\cancel{\frac{22}{7}} \times (3)^2 \times 8}$

$= \dfrac{\cancel{15}^{5} \times \cancel{15}^{5} \times \cancel{32}^{4}}{\cancel{3} \times \cancel{3} \times \cancel{8}} = 100$ glass

capacity of smaller glass $= \pi r^2 h$ $\quad r = 3$ cm

$= \frac{22}{7} \times (3)^2 \times 8$ $\quad h = 8$

Total amount received $= 15 \times 100 = ₹ 1500$

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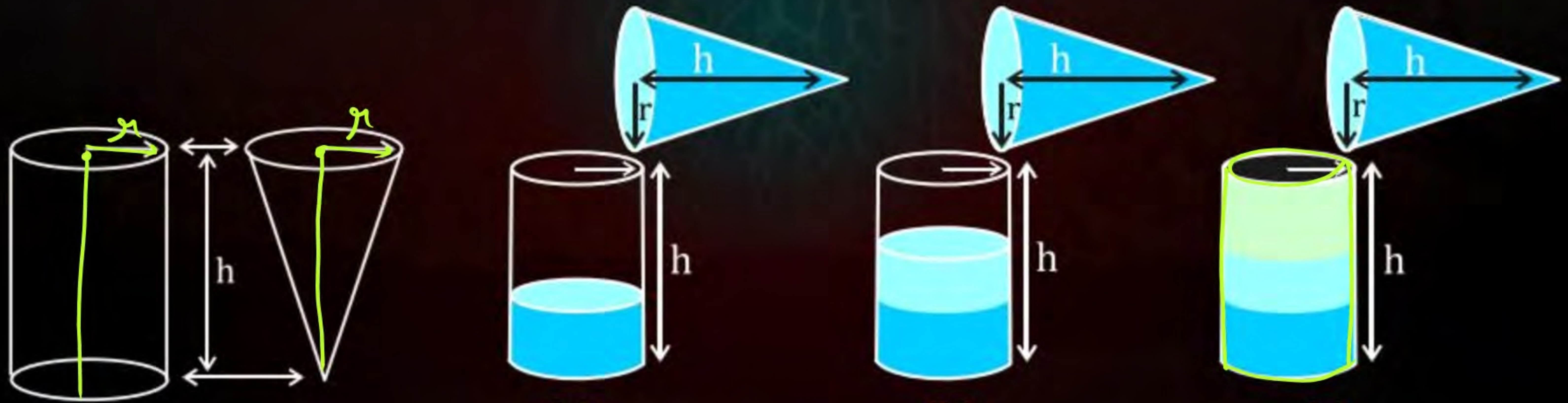
Volume of a Right Circular Cone

To find the volume of a right circular cone let us consider the following experiment.

Experiment :

Take a conical cup of radius r and height h. Also, take a cylindrical jar of radius r and height h. Fill the cup with water to the brim and transfer the water to the jar. Repeat the process two more times. You will find that 3 cup full of brim will fill the jar completely.



(a) (b) (c)

Volume of a Right Circular Cone

From the above experiment, we conclude that

$$\boxed{\text{Volume of Cylindrical jar} = 3(\text{Volume of Conical Cup})}$$

OR

$$\boxed{\text{Volume of Conical Cup} = \frac{1}{3}(\text{Volume of Cylindrical Jar})}$$

$$\boxed{V_{cone} = \frac{1}{3} \times \pi r^2 h} \quad ***$$

Question

A heap of wheat is in the form of a cone whose diameter is 10.5 m and height is 3 m. Find its volume. The heap is to be covered by canvas to protect it from rain. Find the area of the canvas required.

Question

A heap of wheat is in the form of a cone whose diameter is 10.5 m and height is 3 m. Find its volume. The heap is to be covered by canvas to protect it from rain. Find the area of the canvas required.

$d = 10.5 m$

$2r = 10.5 m$

$\boxed{r = \frac{10.5}{2} m}$ $\boxed{h = 3m}$

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

$= \boxed{\frac{1}{3} \times \frac{22}{7} \times \left(\frac{10.5}{2}\right)^2 \times 3}$

Area of canvas required $= CSA$

$= \pi r l$

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

$= \boxed{\frac{22}{7} \times \left(\frac{10.5}{2}\right) \times \sqrt{(3)^2 + \left(\frac{10.5}{2}\right)^2}}$

Question

If the radius of the base of a right circular cone is 3r and its height is equal to the radius of the base, then its volume is

$\frac{1}{3}\pi r^3$

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

$3\pi r^3$

$9\pi r^3$

Question

If the radius of the base of a right circular cone is 3r and its height is equal to the radius of the base, then its volume is

A $\frac{1}{3}\pi r^3$

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

C $3\pi r^3$

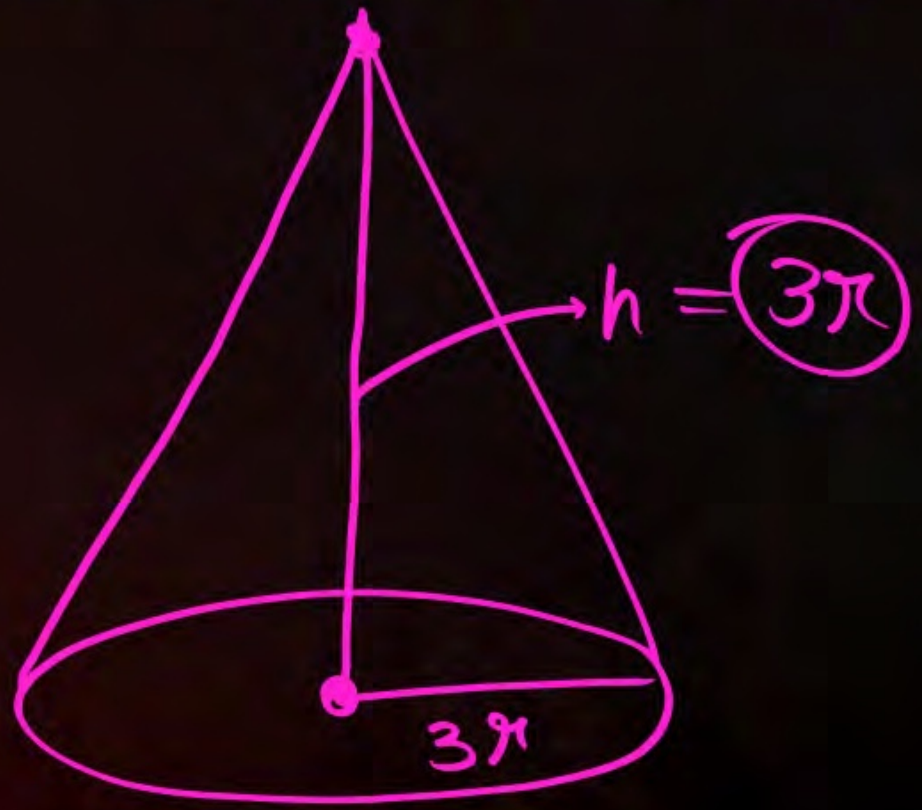
D $\boxed{9\pi r^3}$ ✓

$$V = \frac{1}{3}\pi(3r)^2 \times (3r)$$

$$= \frac{1}{3}\pi \times 9r^2 \times 3r$$

$$= \frac{1}{\cancel{3}}\pi \times \overset{9}{\cancel{27}} r^3$$

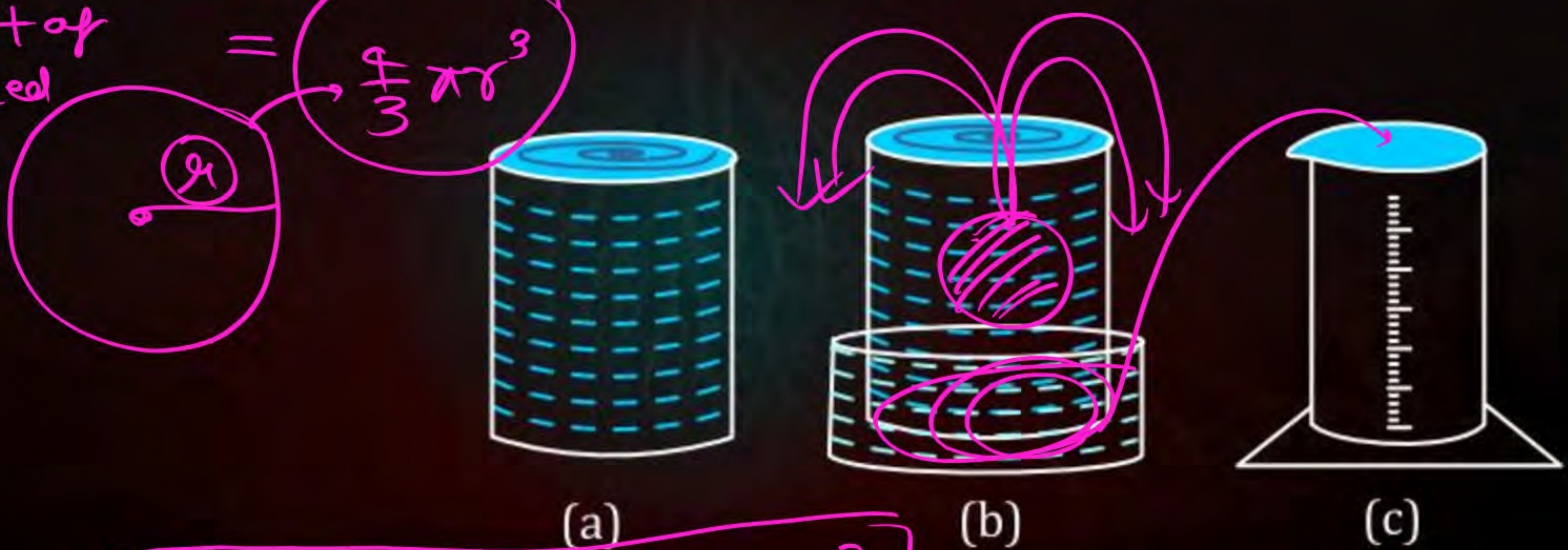
$$= 9\pi r^3$$



Volume of Sphere

To find the volume of sphere let us consider the following experiment.

Amount of Replaced water $= \frac{4}{3}\pi r^3$



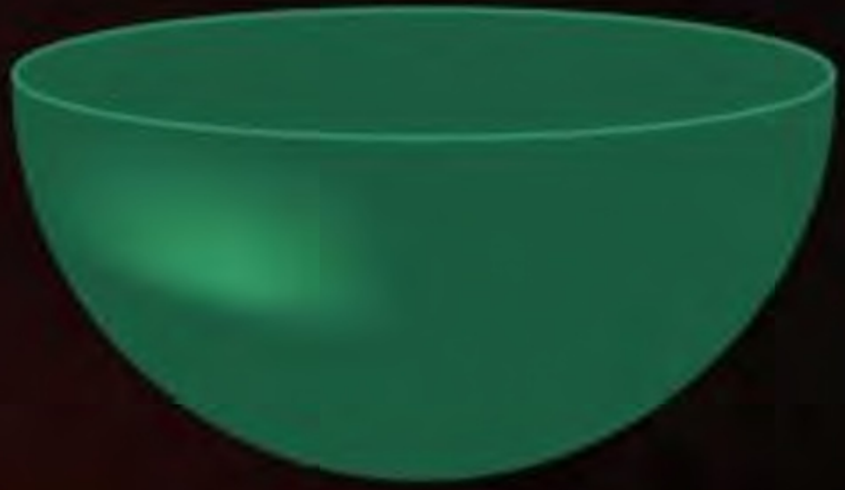
$$\boxed{\text{volume of water} = \frac{4}{3}\pi (r)^3} = \text{volume of sphere}$$

Volume of a Sphere, Hemisphere and a Spherical Shell

We state the following formula :

(i) The volume V of a sphere of radius r is given by

$$V = \frac{4}{3}\pi r^3 \text{ cubic units}$$



(ii) The volume V of a hemisphere of radius r is given by

$$\frac{1}{2}\times\frac{\cancel{4}^{\,2}}{3}\pi r^3 = \boxed{V = \frac{2}{3}\pi r^3} \text{ cubic units}$$

(iii) The volume V of a hemispherical shell of inner radius r and outer radius R is given by

$$\boxed{V = \frac{2}{3}\pi(R^3 - r^3)} \text{ cubic units}$$

Question

A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in mm^3) is needed to fill this capsule?

Question

A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in mm^3) is needed to fill this capsule?

$$\text{capacity} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \frac{22}{7} \times (3.5)^3$$

mm^3

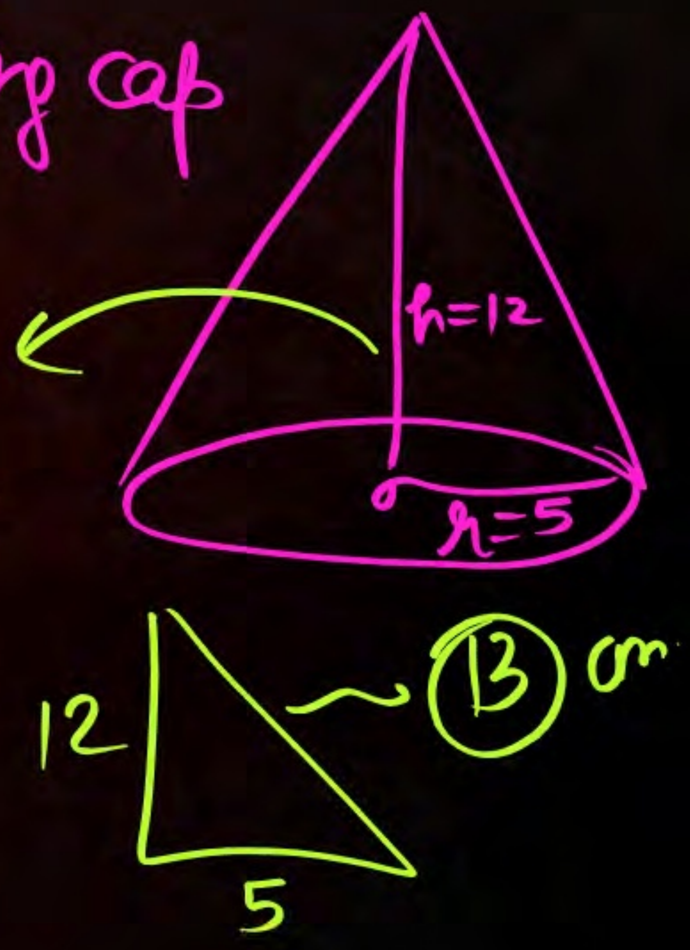
Question

Sameera wants to celebrate the fifth birthday of her daughter with a party. She bought thick paper to make the conical party caps. Each cap is to have a base diameter of 10cm and height 12cm. A sheet of the paper is 25 cm by 40 cm and approximate 82% of the sheet can be effectively used for making the caps after cutting. What is the minimum number of sheet of paper that Sameera would need to buy, if there are to be 20 children at the party? (Use $\pi = 3.14$)

Question

Sameera wants to celebrate the fifth birthday of her daughter with a party. She bought thick paper to make the conical party caps. Each cap is to have a base diameter of 10cm and height 12cm. A sheet of the paper is 25 cm by 40 cm and approximate 82% of the sheet can be effectively used for making the caps after cutting. What is the minimum number of sheet of paper that Sameera would need to buy, if there are to be 20 children at the party? (Use π = 3.14)

82% Area = Actually used for making cap



Total Area of 20 cap

$= 20 \times \pi r l$

$$\boxed{n \times 82\% \text{ of sheet} = 20 \times \frac{22}{7} \times 5 \times 13}$$

$$n \times 82\% \text{ of } (25 \times 40) = 20 \times \frac{22}{7} \times 5 \times 13$$

$$n \times \frac{82}{100} \times 1000 = \frac{20 \times 22 \times 5 \times 13}{7}$$

$$n = \frac{2\cancel{0} \times 22 \times 5 \times 13 \times \cancel{100}}{82 \times \cancel{1000} \times 7} = \frac{2 \times 22 \times 5 \times 13}{82 \times 7} = 4.98$$

$$\approx 5 \text{ paper}$$

$$n =$$

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THANK YOU